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JULY, 1980

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ELECTRONICS Australia

Volume 42 No. 3 July, 1980

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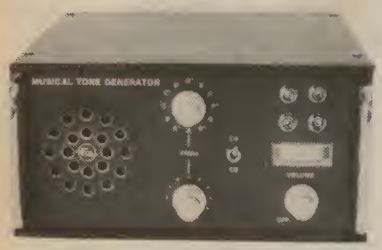
Tuning Standard for musical instruments



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EPROM Programmer

Write your own software into EPROMs with our versatile progammer. This month we give full details of a version for use with the TRS-80, and next month, a version for the Exidy Sorcerer. See p62.

On the cover

An artist's impression of the Space Shuttle launch. Boosters supply the initial thrust, after which the Shuttle will orbit and land under pilot control, trip after trip.

(Cover by Garry Lightfoot.)

FEATURES

HIFI TOPICS AND REVIEWS

PROJECTS AND CIRCUITS

MICROCOMPUTERS

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DEPARTMENTS

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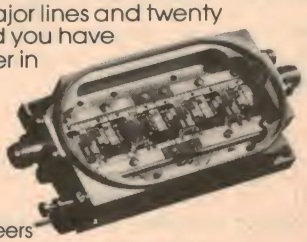

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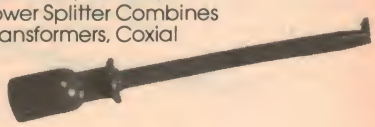

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Editorial Viewpoint

Hit drink/driving at its source

Recently, there has been discussion in the media about the desirability of an electronic device to prevent people affected by alcohol from driving. The idea involves the fitting of an ignition disabling circuit which would prevent starting of the car until the driver blew into a sensor. If the driver was sober, the car could be started. If the driver was not sober, he/she would turn the key in vain.

The device would not be installed in all vehicles, so the argument goes, but would be fitted, by court order, to vehicles belonging to drivers convicted of drink-driving offences.

The concept has apparently been supported in a recent confidential report by the NSW Traffic Accident Research Unit.

Personally, I am far from convinced. Anybody who is handy with a soldering iron and screwdriver could disable or bypass such an installation without too much hassle. Most such devices can be circumvented by one means or another, given the will to do so.

Anyone who thinks otherwise is surely just whistling in the wind. In saying this, I find ample precedent in the widespread tampering with anti-pollution devices on late-model cars. And the chances of being caught are fairly remote.

Even if it was not possible to physically disable such a device easily, what is to stop a "drunken" driver from asking a sober mate to blow into the sensor and then drive away, however erratically? Or, more simply, what is to stop the potentially drunken driver from obtaining a hand-operated "puffer" from a child's toy horn to do the job?

Or, as an even more direct solution, what is to stop the potentially drunken driver from using a vehicle other than his own?

In my opinion, the idea just won't work. Nor will some of these more exotic systems using a keyboard on the dash. These ideas are yet another example of the belief that technology will solve all social problems. And this is a social problem!

If we as a society are really concerned about the problem of drunken driving and the deaths and untold misery it causes, we would pressure our politicians for the immediate introduction of random breathalyser tests. Of course, to be really effective, "random" breath tests would have to be performed outside licensed clubs, restaurants and hotels.

Furthermore, penalties for these offences should be made much stiffer and be more rigidly enforced by the courts.

Finally, we must knock alcohol off its pedestal. It is a dangerous drug and, as with other dangerous drugs, we must learn to regulate its use.

Technology will not and cannot solve the problem!

Leo Simpson

COVER PRICE

We're sorry that we've had to add another 10c to our cover price. We tried to keep it down to $1.50 but rising costs, right across the board, have dictated otherwise.

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News Highlights

OTEC — a promising renewable energy resource

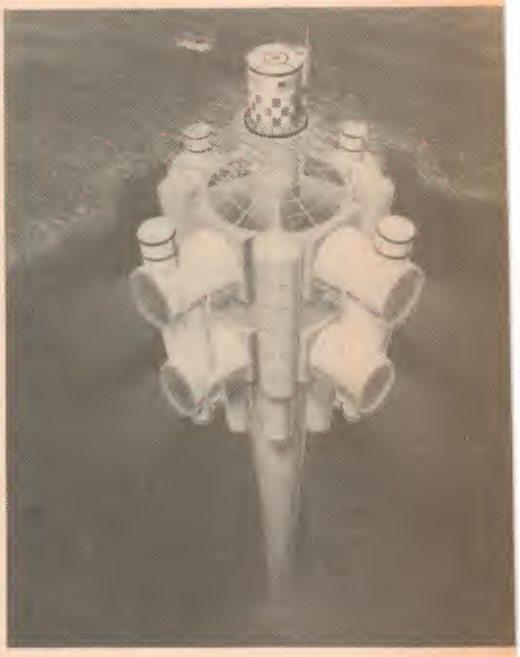
US engineers working on one of the most promising renewable energy sources — ocean thermal energy conversion (OTEC) — are expecting two major developments this year. The first will be in July when a 1MW experimental rig called OTEC-1 is floated out of a shipyard in Washington state to Hawaii for operational trials. Secondly, the US government budget for the technology is to be doubled this year, to $80 million, paving the way for a 40MW demonstration plant in 1984.

The OTEC technique uses the temperature differences between the ocean surface and depths of 1000m or more to extract energy. Cold water is drawn up a massive pipe and used to condense a working fluid (ammonia is the current favourite). Warm water at the surface is used to evaporate the fluid. By pumping the ammonia around a closed circuit the latent heat given off from the change from gas to liquid can be extracted through heat exchangers and used to produce steam to drive electric generators.

Even at low levels of efficiency (5% is the best so far achieved) the costs of OTEC generating stations will be in the region of $2000-$2500 per kilowatt — about the same as present nuclear power stations, and the ocean power plants have other advantages such as a long operating life and absence of dangerous waste products. It has been predicted that efficiencies of 10% will be possible by the year 2000, by which time the US could have 10,000MW plants in operation.

However, significant problems must be overcome. The ocean generating plants are very large structures — a 400MW plant could displace 75,000 tonnes — and they must be moored in depths of well over 1000m, requiring new types of mooring cables and anchors and new ways of using them.

In addition, the most crucial component of the system, the cold water pipe, poses engineering problems that have yet to be solved. In OTEC-1 cold water is drawn up through a cluster of three pipes, 670m long and 1.3m in diameter. The cold water pipe for a 400MW plant would be 1000m long and 30m in diameter, and would pump water at a rate of four million litres per second. The pipes must be strong enough to support their own weight and to withstand the massive pumping pressures.



OTEC uses warm water to vaporise liquid ammonia, which drives the turbine generators. The ammonia is then condensed back to a liquid by cold water and so the cycle continues.

OTEC is considered a form of solar power, but has important advantages over other solar energy processes in that it continues to work after the Sun goes down.

Particle beam weapons — how close?

The development of a particle beam weapon — a device which would project extremely high-energy beams of atomic particles — could run into insurmountable problems, according to a team of researchers at the Massachusetts Institute of Technology.

The MIT team examined the possibility of using beams of energetic particles, either fired from the ground or from orbiting satellites, to shoot down ICBMs or military satellites, and concluded that no presently available machine has all the attributes needed for such a weapon.

The heart of the weapon would be its particle accelerator, and existing accelerators used in high energy physics provide a guide to what is required. Working backwards from the known amount of energy necessary to damage a missile, the MIT researchers calculated that a particle beam weapon would require an accelerator operating at 1000MeV — which is well within the range of existing accelerators.

However, existing accelerators provide this energy at low current. They produce a beam of particles with a current — a measure of the number of particles within the beam — of around .025A, which is far short of the 1000A required for a weapon. Other shortcomings of present accelerators are the low amount of energy in each pulse (56 jourles instead of 100 million); the time each pulse lasts (1.5us instead of 100us); and the rate at which they can produce pulses (50 per second instead of 100).

Even if it does prove possible to develop a satisfactory accelerator there are still problems to be overcome in operation. For example, if the weapon was placed in orbit around Earth, interference with the communications between the satellite and the controlling ground station could prevent its use. In addition, if the particles in the beam were energetic neutral hydrogen atoms, a thin later of air would be a good shield. The air would strip the electrons from the hydrogen atoms, leaving a beam of protons, which would break up as the protons repel each other.

JVC readies VHD videodisc

JVC's VHD (Video High Density) videodisc system was demonstrated in production prototype form at a Tokyo press conference recently. The system uses a grooveless, capacitive pickup, and each 30cm disc contains two hours of colour programs with sound. With the addition of a PCM (Pulse Code Modulation) decoder the system can also play high fidelity stereo sound recordings.

The videodisc player provides a variety of special effects such as still, slow-motion and fast-motion, forward and reverse operation and a fast search mode. In addition there is a random access capability, so that a pre-selected single "track" can be located and played back automatically.

Picture and sound information are recorded as pits on the disc surface without grooves to guide the pickup stylus. Video information and tracking signals are simultaneously picked up as capacitive variations between the disc surface and an electrode on the stylus.

The discs are made of conductive PVC material and rotate at 900rpm (twice the speed of the RCA disc and half the speed of the Philips/MCA disc). Disc life is approximately 10,000 replays, and the stylus is made from sapphire and has a life of around 2000 hours. JVC plans to commence production next year, and the system is expected to sell for about $500.

Electronic speedometer has memory & LCD

Liquid crystal displays and a non-volatile memory system combine to give this new electronic speedometer from National Semiconductor.

National Semiconductor Corporation has developed an electronic odometer with a non-volatile memory that can retain a vehicle's total mileage under all conditions, including loss of power in the vehicle. The system is designed into National's intelligent instrument panel, and uses a fusible link bipolar PROM for mileage storage and a low-cost COP420L four-bit microcontroller.

The microcontroller counts pulses generated by a speed sensor and programs one bit of the PROM for each increment of the mileage total. The controller can also use the pulses to determine the speed of the vehicle. Either total mileage or the distance covered on a particular trip can be displayed at the user's option, and odometer and speedometer information can be displayed in either Imperial or metric units.

Britain expands nuclear power program

Confirmation of Britain's decision to go ahead with the building of two more advanced gas-cooled reactor (AGR) nuclear power stations was given on April 14 by Energy Secretary Mr David Howell. The two 1320 megawatt stations, which are likely to cost more than $4000 million, were originally given the go-ahead by the previous government in 1978, and work on preparing the sites has already started.

Since the current AGR program was announced in 1964, two stations have been brought into service and three more are now under construction. The new AGR reactors are expected to be a modified version of those already operating, with a bigger pressure vessel to allow greater access for inspection and repair and a bigger core to ensure that power is maintained without corrosion problems.

Approval has also been given for the design and manufacture of equipment for a third new nuclear power plant. Unlike the other two, this will use a pressurised water reactor (PWR) built under licence from American Westinghouse.

Although the new station will use technology incorporated in the PWR station involved in the accident at Three Mile Island, it is believed that strict safeguards will prevent a similar incident in Britain. Construction is planned to start in 1982.

Russia closing the "technology gap"

The American government is afraid that the Soviet Union is closing the "technology gap" by clandestinely obtaining high-technology products such as computers, laser components and equipment for manufacturing electronic components, in spite of President Carter's ban on the export of such equipment to Russia.

A US Senate subcommittee has been investigating reports that powerful computers have reached Russia after they had been sold to another country. Although the United States is still about five years ahead of the Soviet Union in microelectronics, the gap is narrowing.

Part of the problem is that a computer is a general purpose machine. For example, a computer sold with a package of programs for developing, say, synthetic fibres, can be later re-programmed to do stress calculations for the design of a supersonic bomber. While a computer might be sold with a package of innocuous software, there is nothing to prevent the purchaser from reselling the computer with software that can be applied to military uses.

Huge impact seen for cable television

Technological developments in the television industry in the 1980s will bring about major changes to current programming and regulatory practices, according to Mr Bruce Gyngell, the former chairman of the Australian Broadcasting Tribunal.

Speaking at a television seminar organised by the Australian Association of National Advertisers, Mr Gyngell said that the effect of cable television, in particular, will be shattering.

Cable television is at present serving 16 million households in the United States, and was first introduced there 20 years ago as a means of relaying normal channels to areas of poor reception. Programs are transmitted to the television receiver by underground cable from a central point, and subscribers pay to join the network and for the programs they watch. Current US prices are $15 for the initial connection and $8 a month on average, with a new movie costing $2 to $3.

Some industry sources believe that

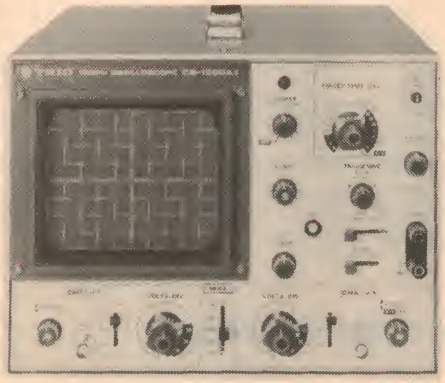
(continued on p7)

John Shillabeer's department is involved in the maintenance, calibration and servicing of all test equipment used within S.T.C. We asked him why S.T.C. used Trio CS1560A scopes.

"My department gets involved with all test gear purchases. As a general purpose scope we've found that the Trio provides excellent performance for its price. Being easy to trigger we find staff can readily get it up and going. On the production line, the bright clear trace makes it an easy scope for operators to use.

"Over the past three or four years, S.T.C. has bought 8 Trio 1560s and we've had virtually no trouble from them. Any minor services have been easy to carry out. As you can see we even use one in our department in the development of our own digital test equipment."

15MHz Trio CS1560AII Dual Trace



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NEWS HIGHLIGHTS

BPO aims for Prestel expansion

The British Post Office is planning a major marketing campaign to increase the number of subscribers to its Prestel services. Although at present the system has only 2400 subscribers, the Post Office hopes to boost this by "tens of thousands" in 1980, and manufacturers producing the television sets that receive Prestel say that by the end of April, 1980 they will be producing hundreds of sets each week.

Prestel is a system which links a television set to an ordinary domestic phone telephone line to bring information from a central computer bank direct to the television screen. More than 150,000 "pages" of information are now on call in Britain, providing facts and services ranging from accounting, agriculture and air travel to wines and yoga lessons. In addition, an international Prestel service is now undergoing tests.

New development will allow full colour photographs to be included on Prestel pages. The new feature will have obvious advantages for mail order businesses, who already use Prestel extensively and for customers placing advertisements. Picture Prestel, as it is called, is scheduled to be in use by the late 1980s, but this addition to existing facilities will require adaptation or replacement of the present generation of receiving sets.

. . . but consumers offer resistance

A recently published book on teletext and viewdata systems says that "the established habit of watching TV as a pastime, for entertainment only", is a major obstacle to the growth of videotext services. These systems will need to overcome serious user resistance to new ways of using the television set if they are to succeed on a large scale, the book states.

The book, "Videotext: the Coming Revolution in Home/Office Information Retrieval" is edited by Efram Sigel, of Knowledge Industry Publications in New York, and contains first hand accounts on the BBC's Ceefax service, the British Post Office's Prestel project, and various tests of these systems made in the US.

Among the author's conclusions are that the initial market for viewdata systems will be among business and professional users, who are accustomed to paying a premium for information delivered quickly.

The book describes the notion of a home information/entertainment centre containing a large variety of entertainment and information retrieval facilities as a "science fiction concept". In reality consumers will be selective, the author asserts, buying one type of device, eg a video recorder, rather than another, such as a teletext decoder.

The book notes that in the first two years of Ceefax service by the BBC in London, only 15,000 sets equipped to receive the transmissions were sold. It may take many years before a substantial number of people are ready to accept videotext services.

Cable television

. . . ctd from p5

cable television will be introduced to Australia in as little as five years, initially with a 30 channel system. Competition for access is likely to be fierce, given the profitability of the system in the United States.

One change predicted by Mr Gyngell is that cable television will remove the pressure from all stations to present programs of particular social value, such as children's programs or Australian-made programs, which he sees as being best provided by cable services. Whether they will in fact be provided remains to be seen.

Cable television will also cause changes in the approach of advertisers. Cable TV does not normally carry advertising, as the cost of the service is paid directly by the subscribers. Mr Gyngell expects advertisers and agencies to overcome the problem, but predicts that the short style of commercial used today will not exist in 1990. One of the alternatives open to advertisers could be to package programs which feature the advertiser's products as an integral part of the plot, as has already been done overseas.

The Australian Broadcasting Tribunal will conduct an inquiry into the issues involved in cable television in July, after the Tribunal's new chairman, Mr David Jones, takes office. Two of the major issues scheduled for discussion are whether Australia can afford cable television (the cost of supplying Sydney alone with cable TV would be in the vicinity of $200 million), and whether overseas capital investment would be allowed and if so how much. The demand for the system by Australian television viewers will also have to be determined.

Dishwasher cleans circuit boards

When engineers at Lockheed Missiles and Space Corporation discovered that the solvents used in customary cleaning processes were harmful to new materials used in electronic circuit boards, they had a problem. A thorough search was made for industrial cleaning equipment using a water-detergent process, but none of the available devices were suitable.

Then someone realised that what the Corporation was actually looking for was a dishwasher with special controls. It didn't take long before engineers developed a programmable control unit and attached it to a commercial dishwasher, creating a simple circuit board cleaning unit, and the most sophisticated dishwasher in the world.

Historic film found in America

A print of the only silent motion picture "epic" made in Australia – the 1927 production of "For the Term of His Natural Life" – has been found in the United States and given to the National Library of Australia. At the time it was made, the film was the longest, most expensive, and one of the most successful products of Australia's young film industry.

The print was found by the American Film Institute in Washington. Although it is of a shortened version made for the American market, it will enable the Library to reconstruct an almost complete copy of the full-length work, using an incomplete print that the Library has been holding for 15 years.

Based on Marcus Clark's novel about an Englishman wrongly convicted of murder and transported to the Tasmanian penal colony of Port Arthur, "For the Term of His Natural Life" was made by Australasian Films Ltd. It cost £60,000, took six months to produce, and was filmed in Sydney and Newcastle and at Port Arthur and other locations in Tasmania.

NEWS HIGHLIGHTS

TI, IBM ready "sighted" robots

At least two major electronics companies – Texas Instruments and IBM – are on the verge of producing industrial robots. Declining productivity has stimulated interest in robots among US manufacturers, and industry sources say that major efforts will be made in the 1980s to put robot manufacture on a commercial basis.

Robots currently under development by IBM and Texas Instruments mark a new stage in robot design because they are equipped with TV cameras which enable them to see and operate on objects in their vicinity. Imaging processing – the conversion of camera images into codes which can be used to control a manipulator – is a very complex aspect of computer programming, but it seems that considerable progress is being made.

Texas Instruments has built sighted robots to help make calculators at its Lubbock, Texas, production plant, and IBM makes similar robots that help in making printed circuit boards for IBM computers, in heat-treating components, and in testing. These developments have been shrouded in secrecy, but sources in the US expect that both firms will announce plans later this year to sell the type of robots that they have so far manufactured for their own use.

TI and IBM are not the only companies trying to produce robots that can "see". Brown Boveri of Switzerland and Philips of Holland are also experimenting with vision systems for robots, and Unimation – the world's biggest robot firm, which claims 70% of the world market – is also working on the problem.

Unimation recently announced an important development in the robot field. A small, lightweight robot called Puma, developed by Unimation in conjunction with General Motors, is expected to start work in one of General Motors' factories soon. Until recently, most robots, as well as being blind, were big and clumsy machines that did fairly rudimentary jobs, using relatively old-fashioned computer techniques. They were also expensive, costing up to $80,000 each.

Unimation's Puma is the first commercial robot that can carry out intricate jobs with the precision of a human worker. The Puma is also relatively cheap, costing from $30,000 to $40,000.

Regardless of the problems posed by large-scale automation, it seems that market forces will demand that manufacturing industries turn to robots in the same way that other businesses have adopted computerised information processing. The social changes needed to accommodate a robot-based economy are vast, but it appears that investigation of the technological aspects of robotics are proceeding at a much faster pace than enquiry into the human factors involved.

Alcohol fuels — counting the cost

The fact that modern farming methods consume very large amounts of energy makes it difficult to see how agriculture can contribute much to the energy needs of industrialised countries by producing alcohol. Researchers at the Louisiana State University have just completed a "net energy analysis" of alcohol production from sugar cane, and their findings indicate that the process may be unprofitable.

C. S. Hopkins and J. W. Day, of the University's Coastal Ecology Laboratory, calculated how much energy is consumed in the fuel and chemicals needed to grow surgar cane and added this to estimates of the amount of energy needed to turn the cane into alcohol. They found that the net energy balance – the ratio of the energy output to the energy input – depends on what fuel is used in the conversion plant.

If the conversion plant is powered by fossil fuels, the net energy balance is 0.9, which means that more energy goes into the plant than comes out of it as alcohol fuel. If, however, waste from the cane fields, known as bagasse, is used as fuel to raise steam the system can produce 1.8 times as much energy as it consumes, although some of it is in the form of steam.

However the US does not appear to be taking this more economical route. According to Hopkins and Day, plants currently under design will use a 50/50 mixture of fossil fuels and bagasse to power the conversion process. The resulting net energy balance would be 1.2, indicating that alcohol production from crops will not make a significant contribution to the country's energy needs.

Lester Brown, president of the Worldwatch Institute, points out further problems of power alcohol production in his paper "Food or Fuel: New Competition for the World's Cropland" (Worldwatch Paper 35). He states that the developed nations' hunt for new sources of fuel, including alcohol production from crops, is a serious threat to food production which may drive apart the rich and poor as nothing else before has done. The price of oil may soon set the price of food, he writes.

In January of this year President Carter announced that the US would aim to produce 2275 million litres of fuel ethanol by 1981 and 910 thousand million litres by the mid-1980s. Brown points out that the goal of 2275 million litres would require the output of almost a million hectares of farmland, or five million tonnes of maize, which represents approximately 5% of projected US maize exports in 1980.

Business Briefs:

- Western Australian based electronics components distributor and wholesaler Reserve Electronics Pty Ltd has been appointed Fairchild distributor for Western Australia. The agreement became effective on February 1 1980, and initial orders for over 200,000 devices have been placed. Reserve Electronics is located at 5 Bookham St, Morley, WA 6002.

- A Melbourne based Australian company, Antenna Engineering Australia Pty Ltd, has been awarded a $2.3 million contract for the design, manufacture, supply, and commission of a high frequency antenna network for the Royal Australian Navy at Humpty Doo in the Northern Territory. The contract is believed to be the largest order for antennas ever placed with an Australian company.

- Vicom's New Zealand operation has moved to larger and better positioned premises. The new address is 84 Whites Line East, Lower Hutt, NZ.

- OTC recently announced the opening of a Brisbane bureau for Overseasfax — a service providing fast transmission of facsimiles of documents and other printed information between Australia and overseas.

  The new bureau is located in OTC's Brisbane office, 380 Queen St, Brisbane.

Shuttle Setbacks

challenge engineers' ingenuity

by JIM SCHEFTER

The behemoth in black and white, a brickyard with wings, stands pointed at the Florida sky. Workers throng in and around it, checking its tiled surface, testing its extraordinarily complex systems, fixing this and adjusting that as they attempt to make every doubt disappear.

But some doubts remain.

This is the Space Shuttle, already several years behind schedule, more than $3 billion over budget, 4100kg overweight, and still tied to Earth.

Its problems have now spread throughout the aerospace industry, sending payload planners scrambling to revise their launch schedules or find other ways to get satellites into space. NASA itself has delayed its Galileo mission to Jupiter and is rescheduling launch timing of communications and other satellites.

What's wrong?

To find out, I spent more than a month digging into the Space Shuttle Orbiter and its problems. I visited aerospace plants where the Orbiter, or parts of it, was designed and built, and NASA centres where its troubles are being analysed. I talked with a score of experts who generally agreed on what is troubling the Shuttle and what is necessary to fix it.

One conclusion quickly became obvious: The Orbiter is the most cantankerously advanced machine ever conceived. It makes flying to the Moon seem easy.

On close examination, it has to be that way. The Space Shuttle is a three-in-one transportation system. It takes off as a rocket, performs its mission as a manned spacecraft, then becomes an airplane for landing back on Earth. With a minimum of repair and refurbishment, it has to be ready to do it all over again one hundred times.

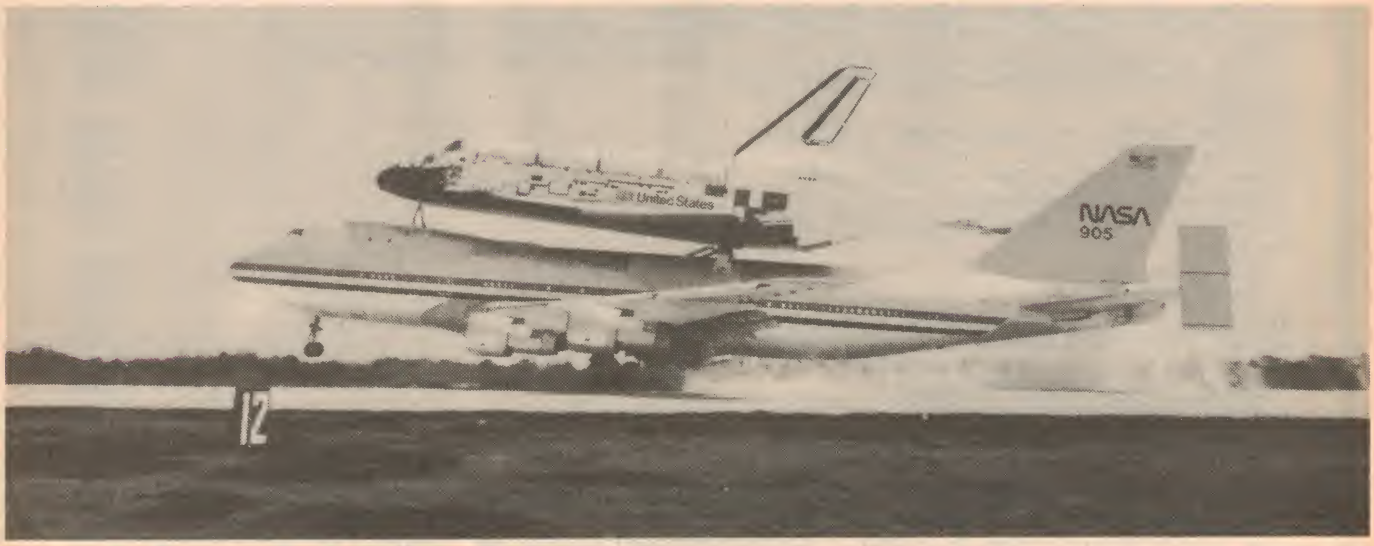
No blank cheque

No one expected to design and build a Shuttle without running into difficult and surprising problems. NASA's whole philosophy of space flight assumes that problems will sprout where least expected.

It also assumes that enough money will be available for fixes. But that hasn't always been true for the Shuttle – NASA's budget has been sharply restricted during the past few years.

The Shuttle originally was scheduled for launch in 1978. When even 1979 became impossible, concern surfaced rapidly. When the delays affected launch schedules for military surveillance satellites, NASA began getting more money.

Now it's beginning to pay off. Most



Riding piggyback *aboard a 747 jet transport, the Shuttle Orbiter "Columbia" journeyed last March from Edwards Air Force Base, California, to Kennedy Space Flight Center, Florida. The seemingly uneventful trip did appalling damage. Flight-caused vibrations loosened the tiles that compose the Shuttle re-entry heat shield. Thousands of tiles had to be tested and replaced.*

Unexpected setbacks in the US Space Shuttle program are challenging the ingenuity of NASA engineers. Some vexing problems have had to be solved so that the world's first spaceship, already two years behind schedule, can get off the ground.

A worker carefully *applies white tiles to the fuselage of the Shuttle Orbiter "Columbia". The Orbiter underwent a successful mock flight last December in which ground-based computers tested the responses of the on-board computers.*

Shuttle problems have been resolved. But four of them, selected by the experts I interviewed, were real demons to fix:

- The Thermal Protection System, a state-of-the-art advance to allow an airplane to survive reentry heating, turned into a bricklayer's nightmare.
- The main rocket engines repeatedly failed during testing.
- Onboard computer software became so complicated that it strained the industry to find enough qualified programmers to do the job.
- The Orbiter's internal structure was too weak. It could have broken in half during normal reentry!

In each case, NASA and its aerospace contractors tackled the troubles with innovation and hard work. The result now is a Space Shuttle that could reach orbit later this year or early next year. Is it safe?

"I'd fly it," said Rockwell engineer Bob Olsen, who spent more than a year on the Thermal Protection System's problems.

He probably won't get the chance. But astronauts John Young and Bob Crippen, tabbed to be first to fly the Shuttle, will have their lives on the line when the thermal system faces its ultimate test.

The system is composed of more than 31,000 fragile, ceramic-like tiles bonded to the Orbiter's belly, nose, wings, and control surfaces. And the slightest failure could mean disaster.

"The system doesn't have much margin designed in," NASA engineer Tom Moser admitted. "In fact, it's designed not to lose one tile."

What would happen if one small tile ripped off during the intense heating and turbulence of reentry? Temperatures up to 1260°C would eat into the Orbiter's aluminium skin. Other tiles would be weakened as well, Moser said, and would begin peeling away. Total destruction would follow.

These vital tiles are made of a fascinating material developed by Lockheed. Nearly pure silica fibres, the tiles start out as a soft white cube that is 97% air and weighs just .14g per cubic centimetre. A heavier version for surfaces that will be subjected to the worst temperatures weighs 0.35g per cubic centimetre and was developed at NASA's Ames Research Centre.

The material can't be handled roughly. Without a surface glaze, it could be pulverized in the fist of a child. And the tiles can't be installed as you'd tile a patio or shower stall.

"It's not like going down to the hardware store for a box of tiles," Rockwell's Olsen told me. "Every tile is different."

Each tile must adhere snugly and smoothly. But some Orbiter surfaces are smooth and flat, while others are curved and bent, even in S-type sweeps. So all 31,000 tiles had to be cut to individual specifications. After being cut and shaped into sections, many no bigger than your hand, each tile had to be glazed for stiffness. Black glaze was used for high-temperature areas such as the belly, while white glaze protects less exposed surfaces.

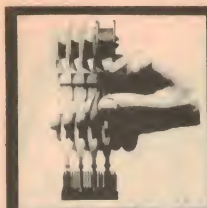
Painstaking work

The glaze was applied on five sides, leaving the bottom soft and powdery. Then arrays of tiles, ranging from two or three to enough to cover a desk top, were glued to a felt "strain isolation pad" that would be glued – by hand – to exactly the right place on Orbiter's thin aluminium skin.

The glue used is nothing unusual. It's a silicone-type sealant, not too different from the stuff you can buy for household use. (Incidentally, the household-type silicone sealants originally were developed for the space program.)

The real nightmare began with installation. Every tile had to be aligned perfectly on all sides, with gaps held to .05-.075mm. And the final surface had to be so smooth that no aerodynamic turbulence would be generated.

But instead of starting from a central point and working outward, the NASA/Rockwell plan called for spotting arrays around the fuselage, checkerboard-fashion, then coming back to fill in the gaps. That only made things worse as installers struggled to insert close-out tiles while perfectly joining



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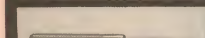

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WD-30-TRI	TRI-COLOR DISPENSER
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WIRE DISPENSER

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WD-30-Y	YELLOW WIRE
WD-30-W	WHITE WIRE
WD-30-R	RED WIRE

DISPENSER REPLACEMENT ROLLS

R-30B-0050	30-AWG BLUE 50 FT. ROLL
R-30Y-0050	30-AWG YELLOW 50 FT. ROLL
R-30W-0050	30-AWG WHITE 50 FT. ROLL
R-30R-0050	30-AWG RED 50 FT. ROLL

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HOOK-UP WIRE

HK-18	18 AWG	25 FT.	SOLID CONDUCTOR
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HK-22	22 AWG	50 FT.	SOLID CONDUCTOR
HK-24	24 AWG	50 FT.	SOLID CONDUCTOR
HK-26	26 AWG	50 FT.	SOLID CONDUCTOR
SHK-18	18 AWG	25 FT.	STRANDED CONDUCTOR
SHK-20	20 AWG	25 FT	STRANDED CONDUCTOR
SHK-22	22 AWG	50 FT.	STRANDED CONDUCTOR
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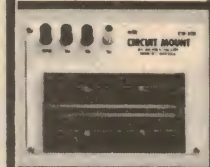


PROTOTYPE BOARD CM-100

TERMINALS: 1,020 TEST POINTS. 188 separate 5 point terminals, plus 2 horizontal bus lines of 40 common test points each.

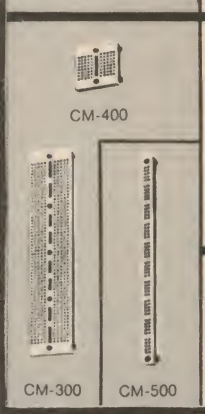
SIZE: 6½" Wide, 5" Long.

CM-100	MODULAR PROTOTYPE BOARD

PROTOTYPE BOARD CM-200

TERMINALS: 630 TEST POINTS. 94 separate 5 point terminals, plus 4 bus lines of 40 common test points each. SIZE: 6" Wide, 3½" Long.

CM-200	MODULAR PROTOTYPE BOARD



PROTOTYPE BOARD CM-300, CM-400

CM-300 and CM-400 have two separated rows of five interconnected contacts each. Each pin of a DIP inserted in the strip will have four additional tie-points per pin to insert connecting wires. They accept leads and components up to .032 in. diameter. Interconnections are readily made with RW-50 Jumper Wire. All contact sockets are on a .100 in. square grid (1¾ in. wide).

CM-300	MODULAR PROTOTYPE BOARD
CM-400	MODULAR PROTOTYPE BOARD

MODULAR BUS STRIP

CM-500 is a bus strip to be used in conjunction with CM-300 and CM-400 for distribution of power and common signed lines. Two separate rows of common terminals, grouped into clusters of five. All contact sockets are on a .100 in. square grid.

CM-500	MODULAR BUS STRIP

DIP IC INSERTION TOOLS WITH PIN STRAIGHTNER

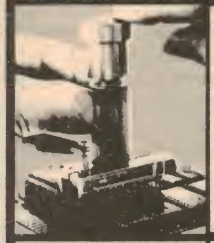
Narrow profile. Pin straightener built into tool. Automatic ejector.

INS-1416	14-16 PIN DIP/IC INSERTER

MOS, CMOS-SAFE

GROUND STRAP NOT INCLUDED

MOS-1416	14-16 PIN, MOS CMOS SAFE INSERTER
MOS-2428	24-28 PIN, MOS CMOS SAFE INSERTER

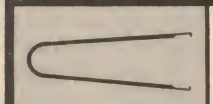


36-40 PIN CMOS-SAFE IC INSERTION TOOL

Aligns bent out pins. Includes terminal lug for attachment of ground strap.

GROUND STRAP NOT INCLUDED

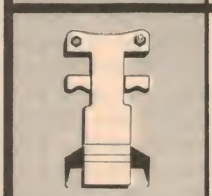
MOS-40	36-40 PIN CMOS SAFE INSERTION TOOL



DIP IC EXTRACTOR TOOL

Extracts all LSI, MSI and SSI devices of from 8 to 24 pins.

EX-1	EXTRACTOR TOOL



24-40 CMOS-SAFE EXTRACTOR TOOL

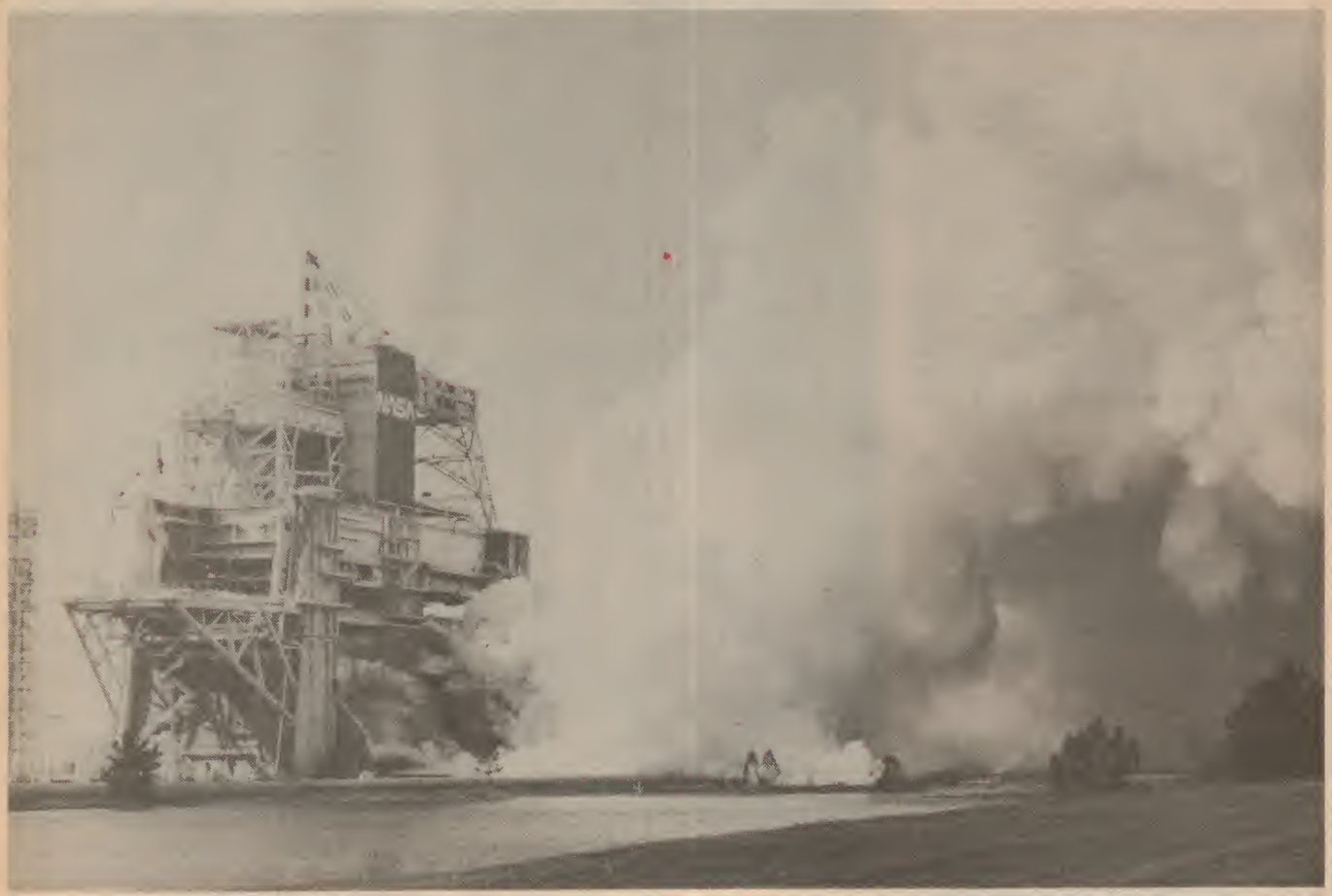
Removes 24-40 pin IC's, .600" centers. C-MOS safe. Includes terminal lug for attachment of ground strap.

GROUND STRAP NOT INCLUDED

EX-2	CMOS SAFE EXTRACTOR TOOL

AMPEC ENGINEERING CO. PTY. LTD. 1 Wellington Street, Rozelle, 2039. Tel. (02) 818-1166. **Available from: NSW** David Reid Electronics, 29-6601. Radio Despatch Service, 211-0191. Electronics (Distributors), 636-6052. Martin De Launay, 29-5834. Applied Technology, 487-2711. **Vic.** Radio Parts, 329-7888. Stewart Electronics, 534-3733. Arlin Instruments, 569-6984. Ellistronics, 602-3282. **S. Aust.** Protronics, 212-3111. **W. Aust.** Reserve Electronics, 328-3116. **Qld.** Wilber Sales, 391-5136.

Shuttle setbacks: $3 billion over budget



Smoke billows *from Shuttle main engines after a premature shutdown during tests. Scheduled to fire for 510 seconds, the three-engine cluster lasted only nine seconds before a malfunction cut it off – causing a damaging fire (see text). By late 1979, the same engines had successfully fired for 540 seconds – more than enough to get the Shuttle into orbit.*

arrays.

It was slow going and added significantly to the time it takes to build an Orbiter. In a good week, only about 600 tiles could be installed. Most weeks weren't good.

"We were kind of naive," said Don Whitman of Rockwell's Space Division in Downey, Calif. "It seemed like a simple thing to do, but it was a tough learning curve."

Then tiles began falling off.

When NASA ferried the Orbiter Columbia from California to Florida atop its Boeing 747 transport, the little deflections and vibrations in the Shuttle's skin loosened the bonding. Dozens of tiles popped loose.

So, in late 1979, Rockwell faced the enormous task of pull-testing every tile already installed, more than 20,000 at that point. An easy, 14kPa pull test had been planned anyway. But now, each tile was pulled to at least 42kPa, some to more, while being monitored with sensitive acoustical devices.

"We were listening for the failing of fibres between the tile and strain isolation pad," Olsen explained.

If a tile flunked the test, it was removed. Its soft bottom was densified with a liquid silica that soaks in about 2.5mm. Then it was rebonded to the felt pad. It all took time.

"We'd have come on this problem a lot earlier if we'd planned our program a little better," Ron Kubicki, former Orbiter engineering manager at Johnson Space Centre, said, "If you leave any chance for error, you'll get it."

Tougher tiles

But the innovative work that went into perfecting the tiles has led to even more advanced materials that will be used on later Orbiters now being built. With weight a strong consideration (the current "lightweight" tiles still account for about 9100kg), Dr Howard Goldstein and his co-workers at Ames have come up with a lighter, much stronger material needing no glazing. Called Fibrous Refractory Composite Insulation, the stuff is a mixture of two recently developed materials. It's 20% Nextel, an alumino-borosilicate fibre from the 3M Company, and 80% Microquartz, a nearly pure silicate produced by Johns-Manville.

Goldstein and the other materials experts at Ames have perfected ways to blend the mixtures to produce high-strength tiles with none of the current fragility problems. The version likely to be used on the Shuttle weighs 0.19g per cubic centimetre, but is 50% stronger than the strongest tiles now used. The material can be machined easily, and will even hold screws. It also sticks tight with silicone-based glue.

"And it's totally thermal-shock resistant," Goldstein said. "You can take it out of a 1260°C oven and drop it in water with no effect."

Some of the new tiles will be on the second Orbiter to reach space. By the third Orbiter, all high-temperature black tiles will be replaced by the new tiles. The low-temperature white tiles also may be replaced, but by a blanket of quartz cloth also developed at Ames. This flexible blanket, now getting intense testing, eliminates virtually all of the installation problems caused by the current tiles. It's also cheaper: $1000 per square metre of blanket versus $40,000 per square metre of tile.

Reluctant rockets

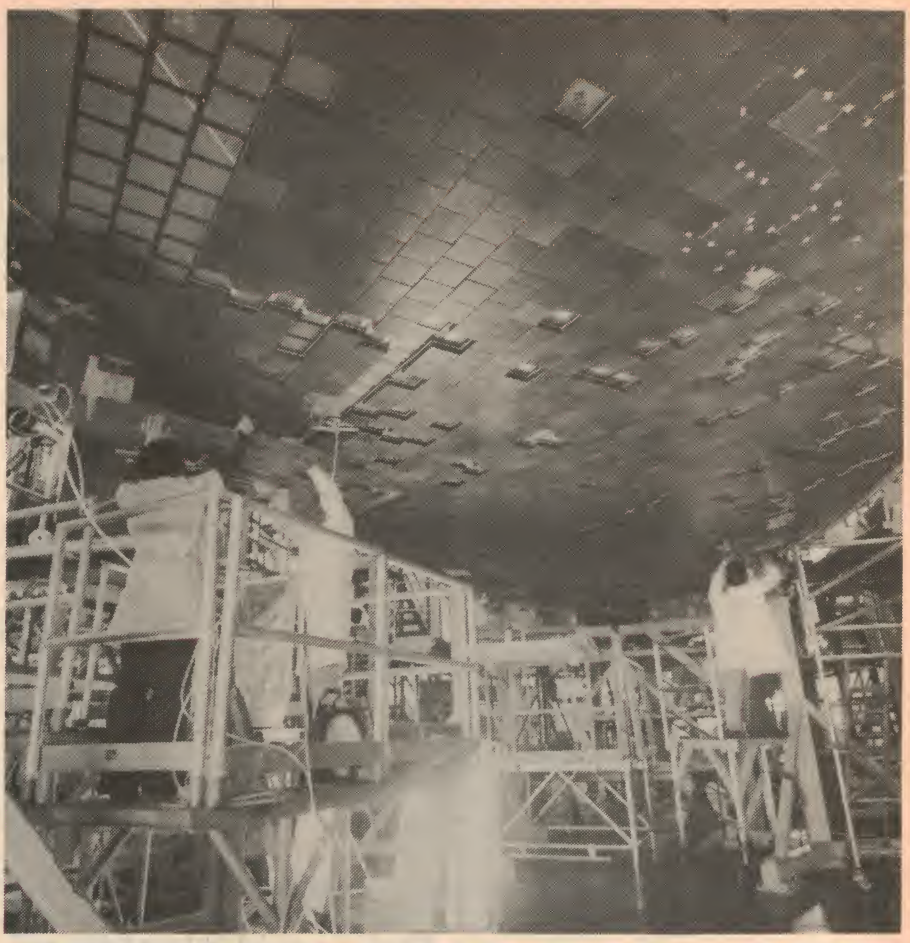
If thermal protection has been the Shuttle's worst problem, its main rocket engines, using hydrogen and oxygen for fuel, have been the most visible. They've

Shuttle Setbacks

blown apart during tests, shut down prematurely, suffered bearing failures and destructive internal combustion, had welds break, and lost critical components in dramatic incidents.

One explosion and fire, in July 1979, so badly damaged the rocket stand at the National Space Technology Laboratories that testing was delayed nearly four months. When it resumed in November, a three-engine cluster fired only nine seconds before a turbopump problem triggered a shutdown.That, in turn, ruptured hydrogen lines and started another fire.

"The sudden shock of engine shutdown was too much for the cooling system. A weld broke, pure hydrogen spilled out, and an intense fire engulfed the engine".



Workers apply *and test heat-resistant black-tiles to Shuttle's underbelly. No two tiles in the more than 31,000 set are exactly the same!*

At that point, with the Shuttle already about 20 months late, preliminary flight certification on the Space Shuttle Main Engine was less than 80% complete.

"This engine is pushing the state of the art," Rocketdyne's Jerry Johnson told me at the Canoga Park, Calif, plant where it is built. "When you want high thrust in a small package, you add complexity."

For instance, to get its 1.7 million Newtons of thrust, the engine has a higher chamber pressure (20,680kPa) and higher expansion ratio (77) than any rocket engine ever built. The big J-2 engine used in the Saturn Booster's upper stages had a chamber pressure of just 4826kPa and its ratio between combustion-chamber opening and nozzle was 27. And the J-2 didn't have to survive for mission after mission of prolonged use.

Power pumps

Prime elements in the Shuttle engine's performance, and source of major headaches, are the high-pressure fuel turbopumps. These pumps are smaller than, but four times as powerful as, Apollo rocket pumps.

"You get that power by concentrating on precision," Johnson said. "Everything has to be perfect."

When it isn't, there are failures.

So far, Rocketdyne has redesigned valves and seals, strengthened internal components, even added parts not in the original design. With all this effort, it was still a turbopump problem that led to last November's damaging fire.

Several problems centred on bearing failures. In one case, an engine was damaged when a turbopump bearing overheated and shattered. Since the bearing was cooled by a flow of liquid hydrogen, a real mystery developed.

Then engineers discovered the culprit, Johnson said. The supercold liquid hydrogen was spinning into a vortex, leaving the bearing to overheat in the whirlpool's central hole. A small paddle inserted into the feed line broke up the vortex and put the cooling back where it belonged.

Another bearing failed when high-pressure hydrogen, used as fuel, began spinning through the piping instead of flowing smoothly. The erratic sloshing caused high-frequency vibrations that destroyed the bearing. Rocketdyne remedied that problem by stiffening the bearing to make it more resistant to vibrations.

And there were literally dozens of other problems, both with the turbopumps and with other parts of the engine. Some of the trouble goes back to money. NASA opted for a less-expensive program of testing whole engines rather than individual components. The result was too often extensive damage when something failed.

That's what happened last November. The original failure was traced to a secondary seal in the oxygen-fuel turbopump. The seal allowed oxygen into an internal cavity where it couldn't escape. Pressure soared and the automatic monitoring system shut down the engine and its two mates almost instantly.

"There was little or no damage from the seal failure," Johnson said.

But one engine was damaged beyond immediate repair by what happened next. The inner lining of the Shuttle engine's bell-shape lower unit, or nozzle, is cooled by liquid hydrogen flowing down through scores of small pipes. The sudden shock of engine shutdown was too much for the cooling system. A weld broke (see photo), pure hydrogen spewed out, and an intense fire engulfed the engine. It was put out very quickly, but not before the engine had suffered major damage.

Rocketdyne already had planned a modification to forestall exactly that sort of thing. But it came too late to salvage the November trial and added another five-week delay to engine testing.

Command computer

Virtually every Shuttle problem, every new test result, and every design change feeds back into the Orbiter's incredible software package, the central program that directs the craft's five onboard computers. The system is so advanced that the astronauts have direct control over only two functions – lowering the landing gear and stepping on the brakes after touchdown!

"I have always wanted a really good loudspeaker system."

Today the cost of excellent turntables, cartridges, tape decks and amplifiers has fallen to the point where the average family man can afford equipment of a quality and performance-level that was impossible ten years ago.

But good loudspeakers have remained extremely expensive and, in most domestic hi-fi systems, the rest of the equipment can dramatically outperform the speaker.

Philips have set out to correct this imbalance.

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The Series 4000/1 is available in kit form which means you save money by assembling it yourself.

A total kit, including:

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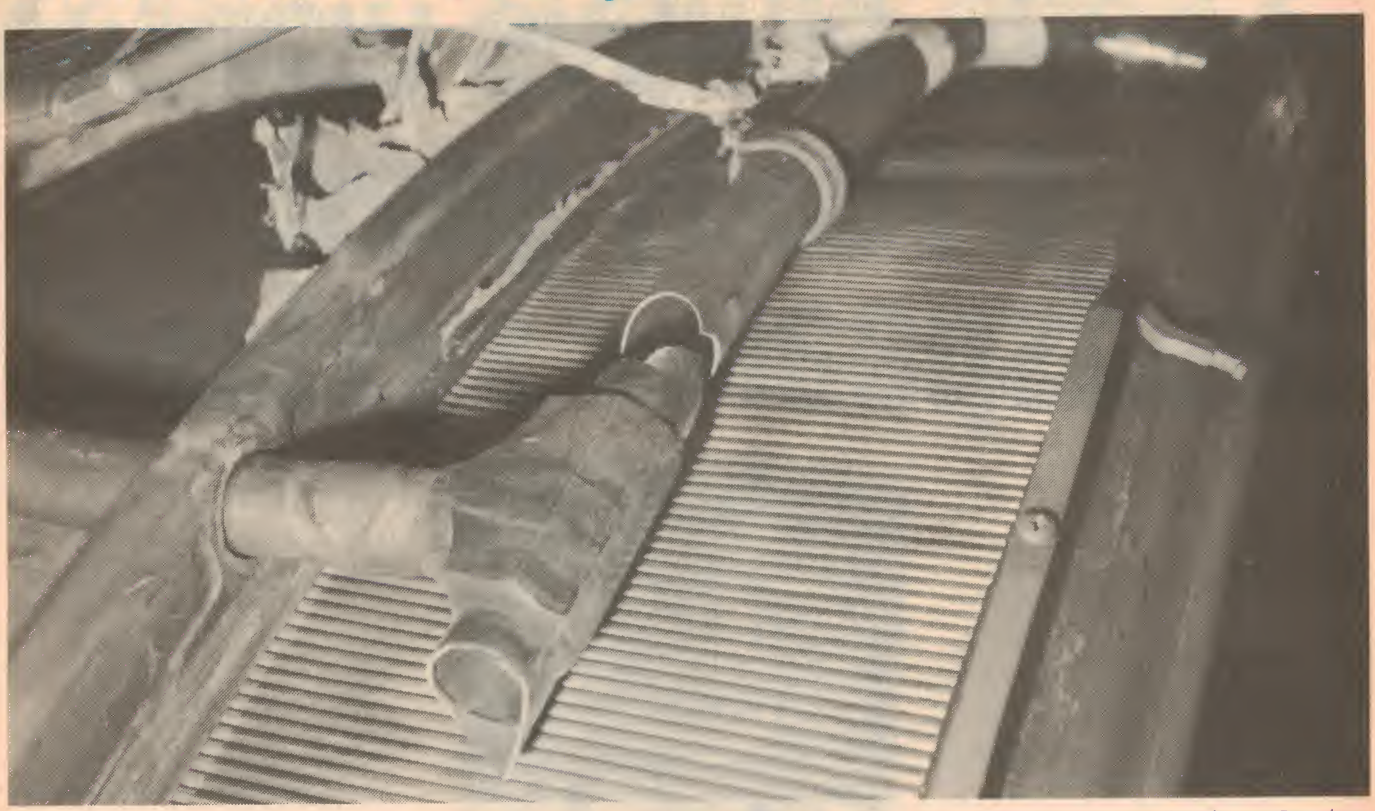
Shuttle setbacks: two years behind schedule



Broken pipe is part of collection system for Shuttle engine's hydrogen coolant. The T-shape pipe funnels used coolant to the combustion chamber where it aids firing. When welds bordering the T broke, the engine didn't get enough hydrogen, and so ran oxygen-rich during shutdown. Result: a serious fire. Weld failures have been traced to use of wrong welding rod.

Everything else can be done by computer.

But that means that the programming must take into account every factor, even the most insignificant, that can affect Orbiter operations. It means reprogramming pieces of the software every time a test result comes in that's different from the original specifications.

And that happens constantly.

One of the latest revisions came only after combined testing of all three main engines began. In the original plan, the computers started the three engines simultaneously for lift-off from the launch pad. When they did, bulkhead pressures soared dangerously.

"It was like exploding three stacks of dynamite under there," said Bill Madden of IBM's Federal System Division in Houston, "We had to rewrite the program to start the engines at 40-millisecond intervals."

That kind of precision timing is typical of what it takes to program the Orbiter's computers. It takes more computer instructions to get the Orbiter safely through reentry than it took to get Apollo home from the Moon.

More than 600,000 lines of computer code have been written and are stored on tapes carried aboard the Orbiter. Most of the work was done by IBM, which at one time had more than 400 highly skilled programmers on the job.

This massive computer program literally runs everything aboard the Orbiter. It handles guidance and navigation, propulsion, attitude control, lift-off, landing, and on through a seemingly endless list.

"The software is the nervous system of the thing," Dr Ken Cox, who manages software development at Johnson Space Centre, told me. "That's what makes it work."

And that's why the computer program is never quite ready.

"We're continually finding out things about the hardware that hadn't been considered before," Madden said.

For instance, testing of the small reaction-control jets that shift the Orbiter's attitude in space turned up the fact that a minimum blip of the thruster lasts about 160 milliseconds. It doesn't sound important, except that the programming called for even quicker blips. A rewrite became necessary.

Just the simple act of firing one of those thrusters requires major computer intervention. Here's a vastly simplified version of what happens when an astronaut wants to change which way the Orbiter's nose is pointing.

A digital signal from the astronaut's rotational hand controller actuates the computer, which then checks back with three transducers in the hand controller. If the signal is verified (still "on"), the middle-value transducer signal becomes a command to the computer to pitch, roll, or yaw the ship.

Now the program races through a series of questions. Which reaction control pod should be fired? (Any one of four could do the job.) Which pod was fired last? (Select them in order to help spread around the wear-and-tear.) Now which jet in that pod is needed? (Pick the proper one for the movement required.)

Finally, the best jet is selected and a firing command goes out from the computer. The whole sequence takes 16 hundredths of a second.

Now the program asks whether or not the thruster actually fired. If it didn't, a new 0.16-second sequence to fire another thruster begins. The computer makes a note of thruster failure and eliminates that jet from future consideration.

That's just one small activity. There are thousands like it that keep an Orbiter working.

"The program is so extensive that nobody can know every detail," said Rockwell's Dr John Peller, "No computer program ever had to work for a rocket, a spacecraft, an entry vehicle, and an airplane."

By mid-winter of 1979-80, program-

mers still struggled with rewrites to get the Shuttle flying.

"When the aerodynamics change, we go back and rewrite software specifications to make it right," Cox said. "When the structure guys have a problem, they strengthen a strut. But it adds weight and it ripples in to our stuff."

Hazardous weight

Weight gain affects more than the computer program, Shuttle engineers discovered. Using the latest data, including every design change so far performed, they unearthed a frightening fact.

"We have an understrength condition," Jim Johnson of Rockwell said. "Our new flight-load data, combined with temperature data, show that at some trajectories, this overloads the airplane.

"It would break."

The news sent tremors through the astronaut office in Houston and had NASA and Rockwell teams scampering to find a way to fix their weakened ship. The problem, Johnson said, developed slowly throughout the past few years.

The Orbiter was designed to perform a 2.5-G manoeuvre during landing. But then it put on weight. That added stress. Heat loads went up a little. That reduced body strength.

Most of the problem was in the Orbiter's mid-fuselage, just where it's hardest to reach. That area already was filled with wire bundles, black boxes, pipes, tubes, and insulation. And the required fix called for installing clips and stiffeners on a large number of T-shape struts that give strength to the ship's skin.

It would be at least a month's work, maybe more. And of course, it would all ripple back into the computer program.

Similar stiffening was needed on a number of wing struts. But since workers could simply walk inside the empty wing and do the modification quickly, there was little impact on the schedule.

But instead of building the Orbiter's strength back up to a 2.5-G tolerance, the added fortifications will give the present craft a tolerance of only 2.0-2.2-G, Johnson said.

"It's a classic problem in airplane design," Johnson explained. "We designed for a set of loads generated four years ago and now we've learned more about them."

The new data already are being applied to other Orbiters being built. Their T-struts are being machined a little thicker to bring the G-loading back up to 2.5 G. But in the meantime, it's just one more problem that helps drive up costs and further delay schedules.

For this first of a new breed of spaceship, that's now a familiar story. Until the Orbiter flies, that part of the story won't end.

The microprocessor goes prospecting

CSIRO's Sirotem wins international award

Last September in Chicago, the Mineral Physics division of the CSIRO won a prestigious IR100 award for its mineral prospecting instrument, SIROTEM. The award was one of a hundred made by the American technical magazine "Industrial Research/ Development" for the most significant new technical products of the year.

by PETER VERNON

Sirotem is a microprocessor based geological prospecting instrument, developed over a period of seven years by CSIRO scientists Brien O'Neill and Dr Jock Buselli. It uses a prospecting technique known as Transient Electro Magnetics (TEM, for short — which is where Sirotem gets its name).

Transient Electromagnetic prospecting relies on detecting and measuring the very small currents induced in an orebody by a transmitted current pulse. By studying how this signal changes as the receiver is moved over the ground, the mineral explorer can find the shape, position, and depth of an orebody.

TEM works in the following way: Current pulses are passed through a large transmitting loop (up to 100 metres square) laid out on the ground. The current creates a magnetic field which extends into the ground below. Each time the transmitter current is changed, the magnetic field collapses and induces eddy currents in the ground. These currents in turn produce their own magnetic field, known as the secondary field. The strength of these induced fields depends on the electrical conductivity of the ground beneath the transmitter loop (see Fig. 1).

Mineral deposits are usually highly conductive compared to the surrounding earth, so they produce a strong magnetic field. This magnetic field induces a current in a second loop of wire which is attached to a sensitive receiver. By measuring this current a mineral deposit may be detected above the response produced by the surrounding earth.

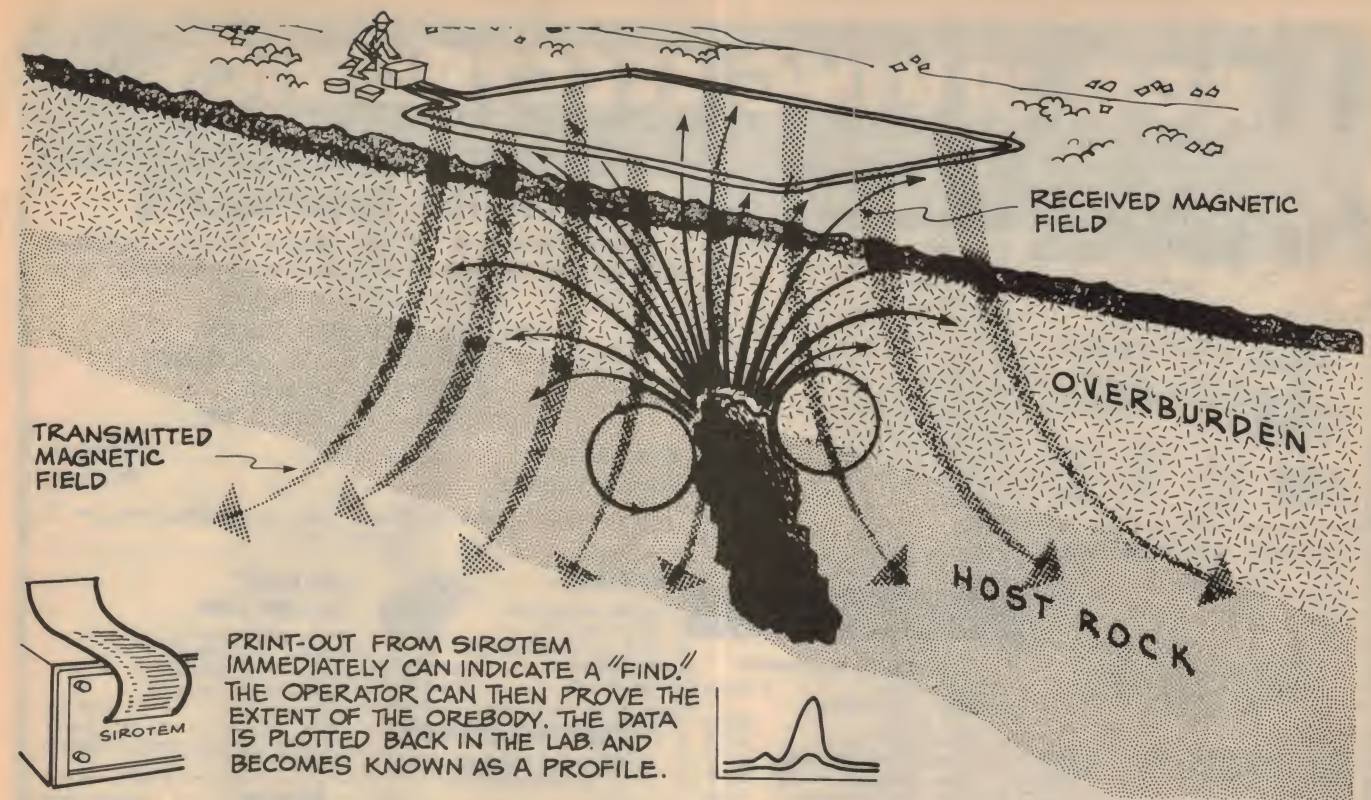
Instruments using the TEM principle were first developed in the United States in the late 40s. They were further developed in Russia, where a reasonably compact instrument was produced which has been used successfully in most countries of the world.

However, when these instruments were used in Australia the results were disappointing. As anyone who has used a metal detector will know, Australia is a heavily mineralised country. The great age of the continent means that extensive weathering has distributed deep layers of diffuse mineralisation (particularly iron oxides) over much of the surface. These mineralised layers, or conductive overburden, as they are called, produce a signal which can completely mask the signal produced by an orebody.

TEM instruments produced overseas were not able to discriminate between the signal produced by an orebody and the signal from the overburden. In addition, the Russian instruments, designed for Russian conditions, were severely affected by the extreme temperatures of the Australian outback.

This was the state of affairs when the CSIRO's division of Mineral Physics began to look for ways of improving the TEM technique for use in Australia. In 1972 they began work on a method of using the relative decay times to reliably distinguish between an orebody signal and the signal from the overburden.

Sirotem consists of two units; a transmitter/ receiver and a battery pack.



Current is pulsed through the transmitter loop and the magnetic field induced in the orebody is detected by the receiver.

"Decay time" is a measure of how long a signal takes to go from its maximum strength to zero. Mineral deposits produce a magnetic field which decays relatively slowly (about 150ms) while signals from the conductive overburden decay more quickly (in about 10ms) because of the higher electrical resistance of the overburden. Thus the response from the orebody can be distinguished from the overburden signal if the response is measured at late time delays.

The outcome of this development work, Sirotem, is able to sample the response signal a maximum of 32 times, in "time windows" ranging in length from 400 microseconds to 25.6ms (see Fig. 2). Transient pulses can thus be measured over a time interval of 165ms. To reduce the data to manageable proportions, wider time windows are used at later time delays, when the signal is changing more slowly.

The problem is that after the signal from the overburden dies away the decaying signal from the orebody is extremely small, only fractions of a microvolt. Special signal measuring techniques had to be developed to overcome spurious noise and interference at these low signal levels.

In 1973 the CSIRO began to use a minicomputer to "average" the signal readings from thousands of scans to overcome the noise problem. For each position of the transmitter loop the current is switched on and off several thousand times. The received signal is converted into digital form and stored in the computer's memory. From this stored data the average value of the transient signals can be calculated.

Noise cancellation is effected as follows: Transient pulses contribute a fixed positive voltage to each received signal, while the contribution due to noise is quite random — sometimes positive and sometimes negative. By adding up a number of samples for each time window, the voltage induced by noise can be averaged almost to zero. The orebody signals reinforce each other in the averaging process, while the noise signals cancel each other out.

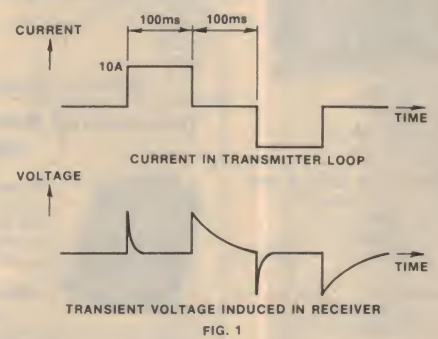


FIG. 1

Although the use of a minicomputer enabled the CSIRO to demonstrate the feasibility of the refined TEM method, the equipment was hardly portable. The computer alone weighed 20kg. Then in 1974 microprocessors became generally available in Australia and the minicomputer could be replaced by a microprocessor board weighing a mere 200g.

The first prototype to use a microprocessor was completed in 1975 and tested in extensive field trials. It was found to be at least 50 times more

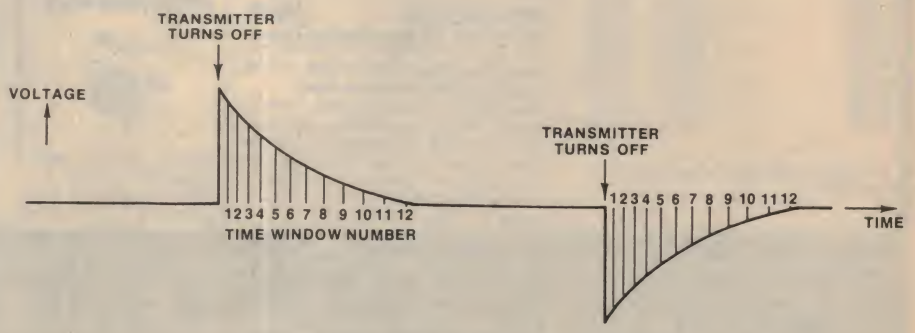


FIG. 2 : SAMPLING THE TRANSIENT DECAY SIGNAL

A pulse is induced when the magnetic field of the transmitter changes suddenly.

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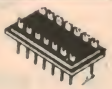

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sensitive than the Russian TEM instruments. Sirotem can detect a field change of one billionth of the Earth's magnetic field, in one thousandth of a second, and is capable of averaging up to 4096 pulses in any one reading to improve the signal to noise ratio of the received signal.

However, this extreme sensitivity created problems of its own. Not all noise can be removed by the averaging process. Distant power lines, VLF radio transmitters, and even tropical thunderstorms on the other side of the world can cause interference which is a hundred to a thousand times stronger than the signal which must be measured.

To counter interference from VLF radio stations, Sirotem uses a low pass filter which allows selected stations to be "tuned out" if they are known to be troublesome in a particular area. If necessary Sirotem can be used within a few kilometres of a broadcast transmitter.

Specially designed atmospherics rejection circuitry detects noise generated by electrical disturbances in the atmosphere and causes the microprocessor to disregard the digital conversion which includes large noise pulses. The noisy conversion is replaced in the data store by the last noise-free conversion to take place. While this introduces a slight time error in the data, this error is much smaller than that caused by a conversion which is distorted by noise.

Sirotem uses a bipolar transmitter, which means that the current pulses fed to the transmitting loop are alternately positive going and negative going, as shown in Fig. 1. The microprocessor controls the turn off of the transmitter, so that the repetition rate of the transmitted pulses can be varied to give better mains-frequency interference rejection.

The repetition rate is chosen so that the phase angle of the mains frequency interference is identical on both positive and negative going transmitter pulses. By reversing the sign of the signal received from the negative pulse, and adding it in the data store to the signal received from the positive pulse, mains frequency interference is cancelled out.

The operation of Sirotem is completely under the control of the microprocessor. Thumbwheel switches on the front panel set the number of pulses which will be transmitted for each reading and the number of time channels which will be sampled. The microprocessor stores the settings of these switches and turns on the transmitter. The received signal is sampled in the required number of time channels and the signal level converted into digital form and averaged over the selected number of transmitter pulses.

Modelling assists the interpretation of results

The output of TEM receiver is of no use unless it can be interpreted. A commonly used aid is a set of plots of the response obtained over a mineral deposit which has been extensively drilled. TEM responses can be compared to other results of the drilling and an interpretation curve calculated. Drilling is an expensive business however, and the types of geological formations which can be studied in this way are limited.

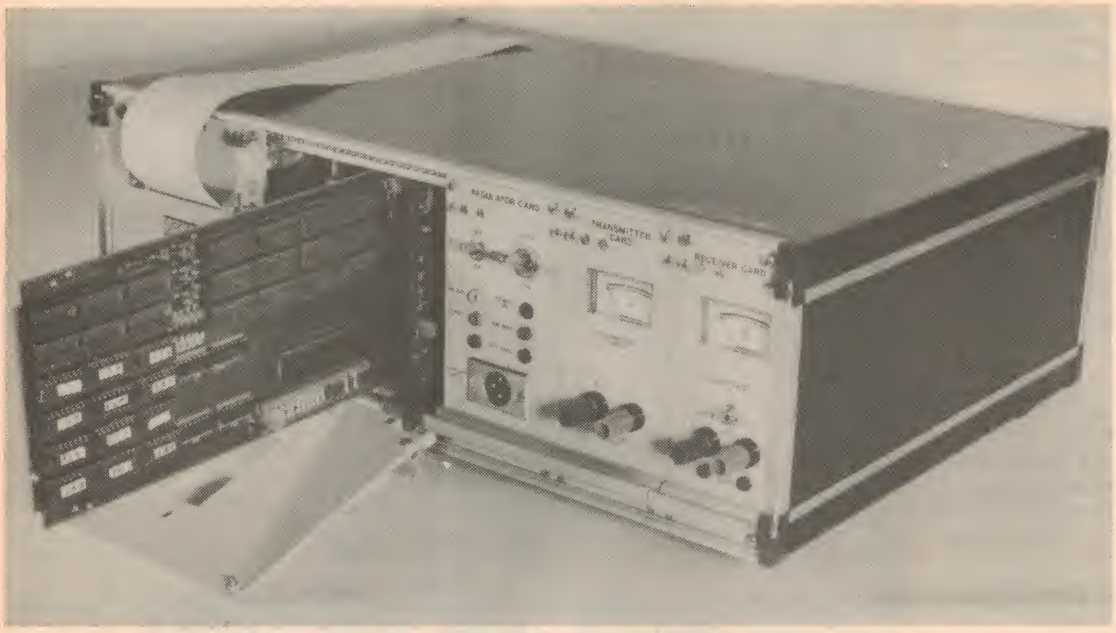
Interpretation curves can also be prepared in the laboratory by calculations made with a small scale model of the technique. The CSIRO maintains a modelling facility in Sydney which can simulate surface or airborne traverses over 1km in length on a scale of 300:1. The geological structure of a particular area can be deduced from the model which produces a TEM response most closely matching the plot obtained in the field.

The model consists of a large fibreglass tank which contains a conducting salt solution which simulates the electrical properties of the rock in which the mineral deposits occur. A slab of graphite which simulates the electrical properties of the mineral deposit is immersed in the solution. Conductive foam is used to simulate the effect of the overburden.

A small sensor coil is moved over the graphite slab and the surrounding solution under the control of a computer. The computer is also used to process the signals from the sensor and produce plots of the sensor response as a function of the coil position over the graphite slab.

To prevent electromagnetic interference distorting the measurements, the room containing the model must be extensively shielded. For the same reason no metal is used in the construction of the facility. All supporting beams are wood, and nylon ropes are used to suspend the graphite in the tank.

SIROTEM: the microprocessor goes prospecting



The use of a microprocessor allows a very compact instrument which is exceedingly powerful and versatile.

The use of a microprocessor provides Sirotem with great versatility. The stored data can be mathematically analysed in a number of ways, depending on the operating program, and the results printed out by the instrument's own printer. The raw data can also be transferred to a cassette, at 3000 characters per second, and calculations done at another location.

The operating program for the microprocessor is stored in a set of PROMs, which can be easily changed if a different mode of operation is required. Test and diagnostic programs are also available on PROMs which can be plugged into the microprocessor board to assist maintenance.

The use of a microprocessor also makes the instrument extremely compact. The transmitter and receiver, microprocessor and printer are all contained in one unit which weighs 8kg, and can be carried by one man. The separate, rechargeable battery pack weighs another 8kg, and provides 10 hours of operation on a single charge.

To reduce the weight of the batteries required and increase operating time, Sirotem has been designed for the lowest possible power consumption. An IM6100 CMOS microprocessor is used together with CMOS RAMs, which draw very little power. The printer is a special low power device, designed for battery operation.

The PROMs used are bipolar fusible link devices, consuming over 100mA each. The full program memory would normally consume over 2A. This is reduced to around 50mA by controlling the power supply to all PROMs. Each set of three is switched on for about one microsecond when that particular set of instructions is required by the microprocessor.

Even the specification of the battery charging circuitry has been tailored for trouble free operation in the field.

The disadvantage of the normal method of charging NiCad batteries is that repeated over-charging can cause a reduction of battery life. When Sirotem is in the field it is often necessary to recharge the batteries to full capacity in as little as 10 hours. Simple constant current charging at this rate could cause substantial over-charging.

The CSIRO devised a method of sensing the completion of battery charging, taking advantage of the fact that the temperature rise which occurs at the completion of charging causes a slight drop in the output voltage of the battery.

When Sirotem's battery pack is connected to the mains, the battery charging circuit delivers current for a set period and then turns off. The open circuit voltage of the battery is then converted to a digital value and compared with earlier values, and a drop of greater than 25mV per cell (corresponding to a temperature rise of 5°C after charging has been completed) causes the charging cycle to cease.

As can be seen from this article every aspect of Sirotem has been designed for accuracy, reliability, and ease of operation. It is the most advanced electromagnetic prospecting instrument in the world, as recognised by the IR100 award, and at the same time it is particularly adapted to Australian conditions. It represents a triumph for the CSIRO and for the Australian manufacturer, Geoex Pty Ltd of South Australia. So far 15 of the instruments have been sold, and substantial export orders are expected.

BELOW: The averaged values for each channel are printed out as a series of numbers.

Channel Number	Normalised Voltage nV/A
0	00631626
1	00529118 2
2	00454878 2
3	00393028 6
4	00339473 4
5	00271377 4
6	00197035 0
7	00147012 6
8	00108190 2
9	00078596 6
10	00051294 2
11	00027383 8
12	00014644 6
13	00008103 8
14	00004347 0
15	00001780 6
16	00000579 0
17	00000233 4
18	00000116 6
19	00000068 6
20	00000048 6
21	00000031 0
22	00000027 8
23	00000039 8
24	00000031 8
25	00000035 8
26	00000036 2
27	00000021 0
28	00000011 8
29	00000001 0
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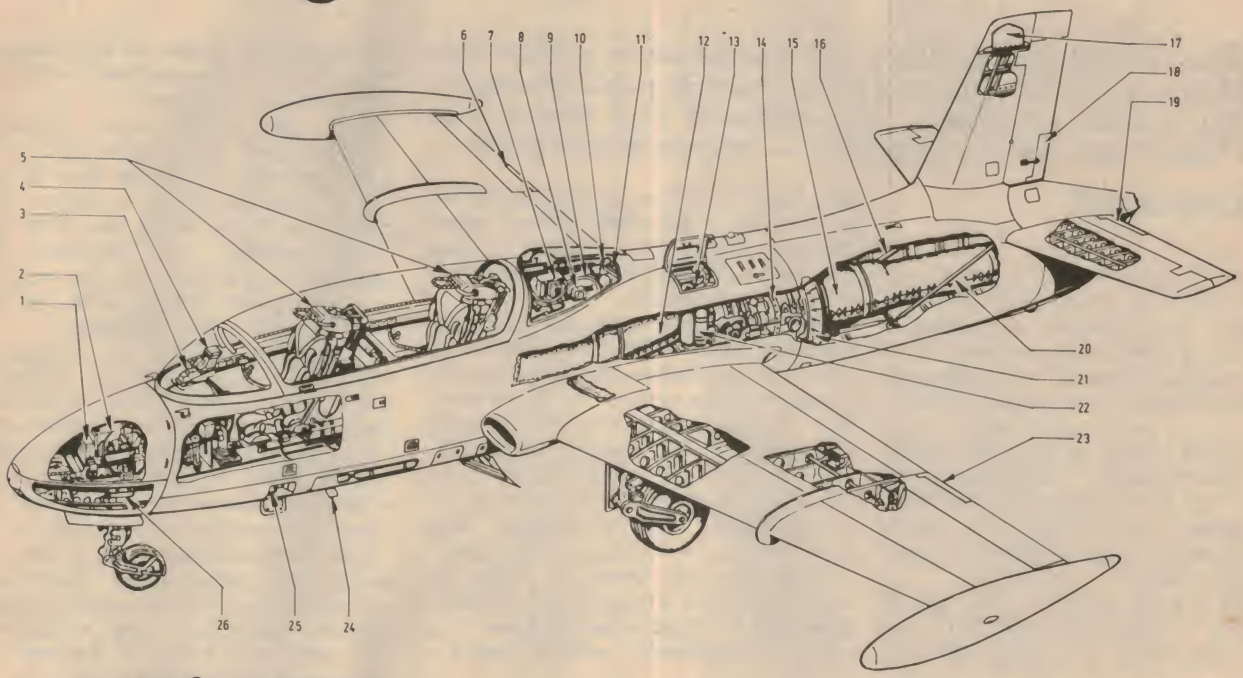

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Computer-controlled urban bus service

Computer control of bus routes and timetables in a West German town has actually attracted people back to public transport. The new system provides a "personalised" bus service that saves time, eases traffic congestion — and conserves petrol.

by DAVID SCOTT

With their gasoline at $2 a gallon and urban traffic jams and parking a growing headache, the Germans are taking a fresh look at public transportation. One exciting taxilike scheme is a computer-controlled local bus service that can save time, money, and frayed nerves. It's a personalised people mover with almost the point-to-point convenience of private cars. But it practically eliminates the congestion and environmental pollution created by large numbers of cars. Fuel conservation is another plus.

A pilot scheme began a year ago in Wunstorf, a commuter-belt town of 37,000 near Hanover, a major German city. There are 24 bus stops spaced a few streets apart — but with no fixed routes between them. On demand, a bus comes to your stop and takes you directly to your destination.

"Average waiting time at a stop is six minutes," said Gert von Lieres of Messerschmitt-Bolkow-Blohm in Munich, designer of the system. "In 12 minutes, 95% of requests are met." The speedy transportation has caught on quickly. "The buses handle three times more passengers than when they were on fixed schedules," says von Lieres. "And there are now fewer cars on the road."

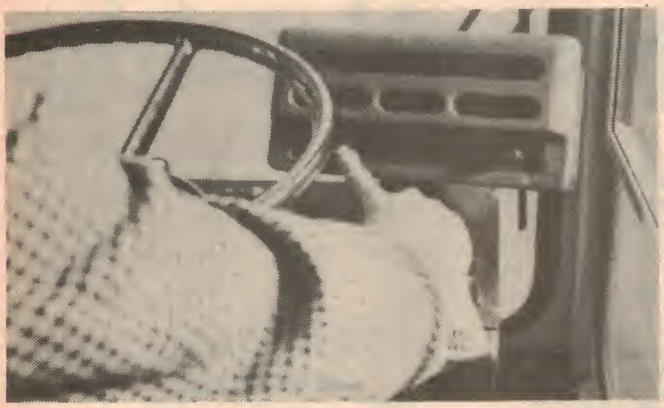
At the bus stop, there is a calling terminal, which has a town map, pushbutton keyboard, and digital-display panels. You pick your destination number from the map and punch it out on the keyboard. As a check, in case you made a mistake, the number is displayed.

Now you insert your personal magnetic-code card into the machine. In a few seconds, the arrival time of your bus — determined by a central computer, which also alerts the driver that you're waiting — is calculated and displayed in a window on the machine. A slip of paper printed with the time identifies you as the passenger.

You pay a small flat fare on entering the bus. If you watch the electronic panel over the driver's head, you can see the name and number of up-coming stops. Since there may be intermediate pickups along a changing and perhaps unfamiliar route, the panel indicates where you are and when to get off.

The central computer keeps track of all buses as they move about. The location of each is signalled over a two-way radio by the driver at each stop. A button on the dashboard terminal registers the name and number of a stop, and the computer then designates the next stop for that bus, flashing it onto the dashboard terminal as a new display. The computer optimises pickups in accordance with requests and shortest travel distances.

So far, only five minibuses are in use. But already they're carrying some 1200 people every weekday. With a full fleet of 30, waiting times should be cut, and buses can be used according to demand.



Dashboard terminal shows driver requests for stops. Driver registers location at each stop with a pushbutton on the readout panel.

Stop number of destination is entered at calling terminal (left). Computer-guided bus (right) reaches request stop in minutes.

Electronic sign on board flashes each stop number along varying route. VW minibus seats eight people.

Spotlight on precision.

The Sanwa name has long been associated with high quality reliable test instruments and has gained wide acceptance in many areas including Telecom, military establishments, research, educational, trade and hobbyists. The above represents a selection of some of the more popular instruments from the comprehensive Sanwa power line up.

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Low Cost 3-in-1 Logic Pulse Scale NEW

YX-380TR

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- Multitester function may be expanded with optional hFE adaptor and HV probe

Versatility Plus Sensitivity NEW

BX808M

- High sensitivity 30μA meter movement
- Simultaneous measurement of A.C. and D.C. signals.
- A.C. signals may be measured even when mixed with D.C.
- Provides logic pulse analysis facilities with pulse and DCV range.
- Instant L.E.D. indication of pulses exceeding 0.5 R.M.S. 0-30 MHz

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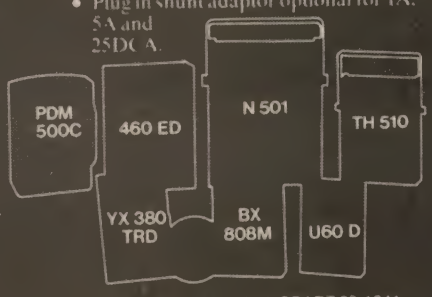

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FORUM

Conducted by Neville Williams

FIRES IN TV RECEIVERS — WHAT ABOUT LIGHTNING STRIKES?

"Forum" for May, which sought to debunk exaggerated stories about exploding TV sets, certainly gained its share of attention from the press and radio stations. One point which came out of the subsequent discussion had to do with thunderstorms: is the family TV set at risk from a possible lightning strike?

Lightning was not mentioned in the May "Forum", mainly because it had nothing to do with the original contention.

In March, newspaper articles had warned readers of the danger of TV sets exploding spontaneously and setting fire to homes – especially if left plugged into a live power point. Our object was to debunk what we felt was a scare story and to relieve the public of a lot of unnecessary worry and hassle. We were particularly concerned at reports of older people nervously groping around at floor level trying to cope with power plugs and switches.

What we said appears generally to have been accepted but a number of readers did raise the question: "What about lightning?" J.P. of Lesmurdie, WA can act as their spokesman:

Dear Sir,

I refer to the article in today's "West Australian" entitled "Theories on TV sets debunked" (p23).

While I have never had any experience of power trouble, I was certainly very glad that I took the advice of the TV supplier who installed a colour TV set for me some years ago. He strongly advised me to remove the antenna plug from the set in the event of a severe thunderstorm, as the antenna could act as a lightning conductor into the set.

During a recent heavy storm, with lightning overhead, I duly pulled out the antenna plug and draped it over the arm of the nearest chair. Subsequently, a jet of flame shot out of the plug, which would certainly have gone into the set,

I rang up the supplier next day and he told me that his shop had received 19 calls for repairs by customers whose sets had been damaged during the storm. I find very few people aware of this possibility – or even ready to believe it. – J.P. (Lesmurdie, WA)

P.S. There is an article in today's "West Australian", page 5, reporting a house in Callangiri gutted by fire "caused by the antenna of the TV set being struck by lightning, and causing the set to explode and catch fire" . . .

The report continues: "The local SEC spokesman said yesterday that lightning would blow up any electrical appliance, even if turned off, that was left plugged into the power point."

So what about the article in "Electronics Australia" debunking this statement? Whom do we believe?

First, J.P.: let's get one point straight: we did not "debunk" any statement about lightning strikes. As we noted earlier, the subject under discussion was a possible explosion and fire caused by an internal fault. The subject of lightning was never mentioned.

What's more, far from any inclination to "debunk" lightning, we have a very healthy respect for it, dating from childhood.

In those far-off days, I lived on a country farmlet, devoid of power lines, telephone lines or anything else man-made to be the focus for a lightning strike. Tall gum trees provided the most obvious path to earth and, on several occasions, I heard or saw them literally blown into pieces by a direct hit. When it happens 20 or 30 metres from the house, you know about it!

Not surprisingly, when family fortunes permitted the purchase of a Colmovox-4 wireless, and necessitated the erection of a large antenna, an automatic inclusion was an aerial knife switch with lightning spark gap, and a thorough earth system. On many an occasion, that spark gap would crackle like a broken ignition lead, before someone thought it wise to earth the aerial directly.

When I later came to live in the City and, in due course, erected an array of amateur band antennas, I could never quite get over their apparent passiveness in terms of static electricity, or the disinclination of fellow amateurs to worry about lightning strikes. Maybe it's because, in the suburbs, one is living within a huge network of elevated power and telephone lines.

This century-old woodcut caught our eye. In 1880, they were worried about the risk of lightning striking gas lamps!

Why, amongst all that, would lightning single out somebody's backyard antenna?

I must admit that the TV antennas which sprout above the roofline of countless homes around Australia look like tempting targets for a lightning strike but, in practice, and on a statistical basis, the worst seems to happen but rarely.

In making this remark, I'm happy to have the moral support of Reg Horne of Electrocraft Manufacturing Pty Ltd (Artarmon, NSW) who have been installing TV antennas around Australia since the early days of TV. At one stage Electrocraft were installing domestic antennas at the rate of several hundred a week and they've lost count of how many thousands they would have erected over the years. But Reg Horne says that he could count on the fingers of one hand the number of instances they've heard about, where domestic TV antennas have been the target for a direct lightning strike.

Even in blocks of home units, where the antenna is usually large and exposed, he can recall only a couple of installations where they have had to cope with mechanical damage to the structure. Where there has been trouble at all, it has normally required internal service only to the distribution amplifier. He could not remember any damage to an individual receiver further down the distribution line.

Reg Horne agreed that: "The chance of a lightning strike to a TV antenna is rather like your chance of winning the big lottery!"

For sure, every now and again, somebody carries off the big prize and gets their name in the paper.

Likewise, every now and again, somebody's TV antenna cops a bolt for the blue, necessitating a call to the friendly local TV insurer!

Curiously it was in the May issue – where the TV set fires were discussed – that our "Serviceman" contributor quite independently told the story of two lightning strikes on amateur radio antennas, one prior to May '80 and the other prior to June '78. Both were direct strikes, both did some damage to electrical equipment but there was no structural damage to the house in either case.

The house fire at Callangiri, mentioned earlier by J.P., would have to be a particularly unfortunate occurrence.

But what precautions do I take personally, when the storm clouds gather? Plenty, some, or none? Well . . .

I have a couple of amateur band antennas, both higher than the TV antenna. Both are of a type such that the structure can be earthed and both are, in fact, earthed to a water pipe driven well into the ground. What's more, the coax leads are never left plugged into the equipment. Aside from a direct strike, it is always possible that a heavy discharge nearby could take out a front-end transistor.

I don't mind removing the antenna from the amateur gear because I'm the only one who uses it and I do so fitfully. The TV set is quite another proposition. It would be a bore to fiddle with the antenna plug every time the set was used – besides which TV antenna plugs and sockets don't have the appearance of being proof against excessive handling.

But I/we do disconnect the antenna if a storm threatens. I don't relish replacing front-end transistors in TV tuners either!

So my advice follows on naturally: if you have an outdoor TV antenna, in the interest of a good picture, make sure that the structure is grounded by means of a stout earth wire and a metal pipe driven into moist soil. Furthermore, if lightning starts to flash around your suburb, and you can exist for a few minutes without TV, disconnect the antenna lead from the set. It might just save you the cost – and nuisance – of a service call.

What about disconnecting the set from the power point, as mentioned in the newspaper article?

Personally, I don't bother because I regard lightning damage via the antenna as the greater risk and this can happen whether or not the set is operating, and whether or not it is plugged into the power socket.

THE POWER PLUG?

The idea of unplugging the receiver is to safeguard it from a possible massive surge, should the power lines be struck. Merely switching the set off should be a reasonable precaution during a violent local thunderstorm but I guess that there is always the possibility of a massive voltage surge breaching the switch.

But, to be consistent, one should also switch off and/or unplug all the other appliances around the home, in case they should suffer the same fate. But here we are in the realms of chance. Given the number of homes and appliances in a suburb, and the number of actual electrical traumas, the risk of one happening to you is very slight indeed.

I disconnect the antennas and leave it at that.

What about other members of our staff?

Assistant Editor Greg Swain lives in a home unit with communal antenna and leaves everything as is, storm or no storm. He has that phlegmatic kind of disposition.

Leo Simpson, on the other hand, would much rather unplug things than run any risk at all of having to repair them later. He's a very canny, careful man . . . wears belt and braces with elastic-topped slacks!

Getting back to the subject of fires in TV sets, the report of a receiver and house fire, due to a lightning strike, does invoke some of the questions raised last month. Did the fire start inside the receiver, which then set fire to the

SAVE A BUNDLE

CEMA ANNOUNCES A NEW DEAL ON THE PHILIPS TOP 40 SEMICONDUCTORS

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BC177	0.20	0.26	0.18	0.23
BC327	0.14	0.18	0.12	0.15
BC337	0.14	0.18	0.12	0.15
BC547, 548, 549	0.09	0.11	0.08	0.10
BC559	0.09	0.11	0.08	0.10
BC639	0.20	0.26	0.18	0.23
BC640	0.20	0.26	0.18	0.23
BD135	0.26	0.33	0.24	0.31
BD136	0.26	0.33	0.24	0.31
BD233	0.34	0.43	0.30	0.38
BD234	0.34	0.43	0.30	0.38
BD677	0.50	0.64	0.44	0.56
BD678	0.50	0.64	0.45	0.57
BF337	0.47	0.60	0.42	0.54
BU126	1.80	2.30	1.65	2.10
BU208A	2.25	2.87	2.15	2.74
BU326A	2.30	2.93	2.18	2.78
BUX80	5.35	6.82	4.85	6.18
BY406	0.15	0.19	0.14	0.18
BYX2IL-200	0.84	1.07	0.76	0.97
BYX2IL-200R	0.84	1.07	0.76	0.97
BYX55-350	0.30	0.38	0.27	0.34

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400mW Zener (BZX79 Series)	0.09	0.10	0.08	0.09
1W Zener (BZX61 Series)	0.16	0.18	0.13	0.15
OA 90	0.10	0.13	0.09	0.11
OA 95	0.11	0.14	0.10	0.13
OA 636-1000 (BYV 96E)	0.39	0.50	0.36	0.46
IN 4148	0.04	0.05	.036	0.05
IN 4004	0.06	0.07	.058	0.07
IN 4007	0.10	0.12	0.09	0.10
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house? If so, what substances were there in the receiver to support active conflagration? Was it perchance an older type set, or a later model from which combustible materials had allegedly been eliminated? Or did the flash fuse the antenna or mains leads and start off a fire simultaneously outside the set?

I don't know.

At the time of writing, I have received two first-hand reports of fires in TV sets due to spontaneous internal failure — nothing to do with lightning. In both cases, the owners had a technical background.

F.G. of Bondi, NSW, told me that his set had only been on for a couple of minutes one morning, when his son called out to say that it was smoking. By the time his wife got to the lounge room, flames were visible but she was able to drag it into the centre of the room away from the curtains.

He raced for a blanket to smother the flames but, no sooner had the blanket dropped into place, than the set "exploded" — presumably due to the tube collapsing. He said that there was never any risk of them being trapped but, by the time things were under control, a fair amount of damage had been done, particularly by fumes and smoke, to fabrics, furnishings and paintwork.

He mentioned that the set was of European design and manufacture "with a fair amount of plastic inside" over and above the usual PC boards and hardware. Whether it was flammable or not, he had no idea.

That might have remained just another unexplained incident had it not been for a letter to hand from Michael Sheriff, Director of "the colour box", 457 Sydney Rd; Balgowlah, NSW. What appears in the accompanying panel is a paraphrase of that letter, amended to include aspects which emerged from a direct telephone discussion.

I suggest you read it at this point.

Mr Sheriff told me that a fire in his own workshop had alerted him to the problem and that he had seen enough evidence since then to know that the failure was not an isolated one. He was at pains to stress that European receivers generally were of good quality and those which had been modified for Australian conditions posed no special problems.

Where the difficulty arose was with sets designed for 220V AC, which had been fed straight on to the Australian market for use on our local mains — 240V in most of Australia but somewhat higher in WA. Allow for some voltage rise when the load on the lines is light — eg summer mornings — and the sets had to cope with high temperatures and (for them) gross over-voltage.

According to Mr Sheriff, there aren't too many such sets around, compared with the total number in use, but he is anxious that his fellow servicemen should be alerted to the potential problem.

A problem in some European sets:

Dear Sir,

We agree wholeheartedly and congratulate you on the sentiments expressed, relative to newspaper articles on colour television receivers and whether it is safe to leave them on standby, etc. We are pleased that, at last, someone has repeated publicly what members of the trade have been saying all along.

But, having said that, we would point out that a few receivers have been imported from other parts of the World (eg Germany and South Africa) where the normal mains potential is 220V AC. If not modified, these receivers can give real trouble when plugged straight into Australian 240V mains.

In most cases, the over-voltage results only in an over-scanned picture and premature breakdown of components. However, some of the unmodified receivers are still fitted with a YELLOW ITT 1uF 220V AC RF filter capacitor, directly across the mains. If it breaks down, it may merely blow the fuses. Alternatively, it can emit acrid smoke and it can spontaneously ignite and continue to burn, even after the power is switched off. What happens after that depends on the vulnerability of adjacent components.

Owners of TV receivers which could be suspected of being imported 220V types would be wise to have them checked. The YELLOW ITT 220V AC capacitor across the mains MUST be replaced with a GREY or BLUE 250V type, which is available from Lawrence and Hanson.

For my own company, we recommend that 220V receivers be fitted with a 240/220V auto transformer, or with resistors and full-wave rectification. Better still, an isolating transformer should be provided (1KVA for half-wave rectification, less for full-wave), in accordance with manufacturers' and Australian Standards specifications and recommendations.

Provided they have been (or are) adapted for our local mains voltage, the receivers I have in mind reflect quality design and manufacture. — M. F. Sheriff.

Don't miss our Giant Sale Mailer in July EA

PARTS FOR NEW KITS

If a kit you want to build is not listed, the parts may be available anyway. Check the Dick Smith Catalogue: or call in to your nearest Dick Smith store.

FAST NICAD CHARGER (See ETI July)
PCB only ..... Cat H-8672 $3.00
(All other components in this kit are normal stock lines)

GUITAR/PA PREAMP (See ETI July)
Short form kit (PCB & components, no transformer or case) ..... Cat K-3035 $29.50

300 WATT AMPLIFIER (See EA June)
Printed Circuit Board Only ..... Cat H-8376 $9.95
(Most other components are normal stock lines)

TV CRO ADAPTOR (See EA May)
Complete Kit ..... Cat K-3060 $29.95
Printed Circuit Board ..... Cat H-8375 $3.75

CONTROL TIMER (See EA April)
Printed Circuit Board ..... Cat H-8374 $2.50
Timer Module ..... Cat X-1050 $17.50

OVER-REV ALARM (See ETI March)
LM2917 IC ..... Cat Z-6112 $2.95
(This project is easily built on Matrix board or similar: all other components are normal stock lines).

ETI 466 300W AMPLIFIER (See ETI Feb)
Complete kit ..... Cat K-3444 $69.00
Printed Circuit Board (f'glass) ..... Cat H-8696 $7.50
MJ15003 O/P transistors ..... Cat Z-1808 $5.00
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PLAYMASTER AUDIO ANALYSER (See EA Feb)
Complete kit ..... Cat K-3510 $99.50
Printed Circuit Board ..... Cat H-8373 $8.50
4136 IC ..... Cat Z-6105 $1.88

GUITAR PRACTICE AMPLIFIER (See ETI Jan)
Printed Circuit Board ..... Cat H-8625 $4.60
(All other components are normal stock lines)

ANALOGUE FREQUENCY METER (See ETI December)
Printed Circuit Board ..... Cat H-8642 $1.95
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NEW TV CRO ADAPTOR

If you're like many people, the old b&w TV is sitting around doing nothing. And you've probably always wanted a CRO. Why not use your TV? This simple kit from Electronics Australia turns your TV set into an audio CRO which you'll find highly useful. The kit comes complete with instructions. Compare our price with others!

PUT YOUR OLD B&W TV TO WORK!
Cat K-3060
SEE EA MAY ISSUE
$29.95

ETI 300W AMPLIFIER

Yes, that's right: a massive 300W RMS. Build two amplifier modules and you've got a 800W stereo system! Or a guitar amplifier, public address amp, etc etc. This kit contains deluxe fibreglass pcb, and all on-board components (but not power transformer, case, etc). A huge number of these kits have been made by enthusiastic constructors: it's a beauty.
Transformer to suit: Cat M-0150 @ $32.50
Case to suit (19" rack mtg): Cat H-2480 @ 49.50

$69.00
Cat K-3444

ETI MIXER/PREAMP

This is a perfect mate for the 300 watt guitar amplifier. You can build it into the same case as the main amp. It features 4 inputs, with level controls, master level and tone controls and is ideal for the guitarist or for PA work. Complete on a single PCB, it is very easy to build.

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FM HAS ARRIVED!!!

At last there's a decent selection of stations on the FM bands. Most people have a tuner capable of receiving FM: all you need is an FM antenna to pick them up!

This FM antenna won't break the bank: and you'll be able to listen to the latest stations on the dial. Very light, easy to erect. Comes complete with saddle clamp. 3 elements.

VALUE! Cat L-4064 **$14.90**

300 OHM FLAT RIBBON
Outside quality ribbon, suits FM antenna above. Cat W-2070
15¢/metre (10c/m 100m up)

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For problem areas. Use with balun for 300 ohms. W-2080
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Use outside or inside: Convert 300 ohm to 75 ohm and vice versa. Cat L-4452. **$2.50**

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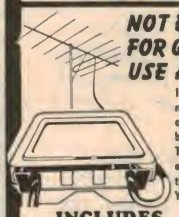

If you can't quite get enough signal for reliable FM reception, why not try one of these TV masthead amplifiers. They work beautifully on FM signals — fit one of these and it could be the difference between pleasant listening and zilch!
This masthead amplifier is easy to fit (full instructions supplied) and is NOT a kit. A separate plug-pack mains adaptor is included in the price: all you have to do is hook it up and you're away.
You'll be so amazed at the improvement in your FM signal, you'll one for your TV as well!

INCLUDES POWER SUPPLY! Cat L-4200 **$39.50**

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Great for mounting antenna just above the roof line. Use with mounts below. Galvanised. Cat L-4156

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Straps securely to chimney, double arm with single strap. Complete assembly. Cat L-4154

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Mounts your antenna from a vertical surface such as a bargeboard. 1.4m long. Cat L-4150

75¢
Keeps ribbon or co-ax away from mast. Easy to fit, secure. Cat L-4512
Also Available: Threaded model for screwing into wood. Cat L-4510 @ 30¢ each (22¢ ea 10 up)

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Use with vertical mast sections. Complete with saddle clamp; 69cm long. Cat L-4153
Also available: 28cm version; L-4152 @ $3.90

WALL PLUG **80¢**
For a professional job. Socket fixes to skirting board, plug takes ribbon to tuner or TV. P-2080

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C60 LN: C-3350 $1.50 ea ($1.00 10 up)
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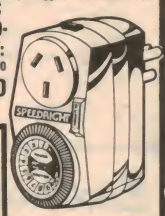
NEW!!!

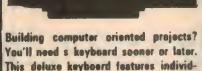
No, you haven't seen this before! It's in the same package as the Discolite and Superswitch, but this one's a motor speed controller. Simple to use: just plug into power point and plug drill, mixer, etc into unit! Suitable for all 'universal' type motors up to 1000 watts (most are less than this). Rugged and reliable, too.

ARLEC SPEED-RIGHT: Cat X-1110 **$25.60**



SAVE OVER $15 ON 63 KEY KEYBOARD

Quality USA manufacture Was $55.00..
$39.50



Building computer oriented projects? You'll need a keyboard sooner or later. This deluxe keyboard features individually switched keys with removable tops (comes in standard "QWERTY" format) with gold plated contacts. Full 83 set ASCII characters. Cat X-1160

NUMERIC KEYPAD TO BUILD:

A huge number of interesting projects can be made with a numeric keypad — here's one that you assemble yourself and so save even more! High quality moulding, all parts supplied. Value!

Cat K-2010 **$3.75**

AND FOR THOSE COLD, COLD WINTER MORNINGS:

This must be the ultimate in comfort: Imagine the coldest seat in the house becoming a beautifully warm place to relax your cares away! Seriously, you owe it to yourself and your family: the soothing comfort of a Dick Smith warmed toilet seat. It's heavenly!

VALUE!
Cat X-2000 **$32.50**

MUSIC HATH CHARMS TO SOOTHE THE SAVAGE BEAST...

How do you like to be woken: a jarring jangling alarm or a soothing tune from your favourite AM or FM station? This modern digital clock radio features huge, bright fluoro display, with auto brightness control at night. Snooze sensor lets you snatch another few minutes shut-eye if you want it! Power failure indicator just in case. We've sold thousands of these! Cat A-4444

$45.00

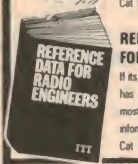
BOOKS: GOOD ENOUGH TO GO TO BED WITH!

1980 ARRL HBOOK
The Amateur's 'Bible' Everything you need to know to pass your amateur theory exam. Used the world over.
Cat B-2218 **$15.95**

ELECT. VEHICLES:
They've got to be the way the auto world is heading. Find out about this exciting field NOW.
Cat B-2400 **$8.95**

DICK'S FUN WAY INTO ELECTRONICS
Now in its third printing: thousands sold! Great introduction to electronics for beginners from 8 to 80.
Cat B-2600 **$4.95**

The BASIC H'book
By Dr David Lien. A recognised masterpiece in its class: tells you ALL about BASIC.
Cat B-2335 **$15.95**



REFERENCE DATA FOR RADIO ENG.
If its data you want, this book has it. One of the world's most respected sources of information. Huge!
Cat B-1104 **$35.00**

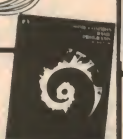
INTRO. TO PASCAL
'Highly recommended' says Jim Rowe. A look at one of the newer and popular computer languages. Worthwhile!
Cat B-2365 **$13.95**

INDY IGNITION: fit it yourself and save!

Because you're technical, why not fit an 'Indy' electronic ignition to your car. With the price of fuel these days, you don't want to waste a drop. Indy will help get the most from your car! **$29.95** Cat A-8530

SYST. 80 & TRS-80 OWNERS:

Check this book out: over 75 programs for everyday usage: interest, depreciation, algebra & calculus, statistics, etc. An incredibly useful work! **$9.95** Cat B-2345



BACK IN STOCK!

Our very popular 3-way torch is now back in stock: if you missed out last time, hurry in. Features large fluoro tube for bright general light, plus spot and flashing amber light for safety. Comes complete with handy carry strap.

$14.95 Cat X-1084

Dear Customers...

Quite often, products we advertise are completely sold out within a few days. Or problems may hold up delivery of promised goods so they are not in the stores when the advert appears. Please don't blame the store manager or staff: they are powerless to do anything about it! What we are trying to say is that if you are about to drive across town to pick up a particular line, give the store a ring first: just in case!

Dick Smith and Staff

DICKTRACER Mk II: best value radar detector around!

Radar detectors come and go: the Dicktracer is still the best value around! Why pay top prices for extra performance you don't really need? The Dicktracer will give you enough warning in most instances: so save money!

Cat A-8500 **$39.50**

MEASURE IT

ECONOMY MULTIMETERS FROM DICK...

What value! Simple, rugged & reliable: with 11 ranges. 1000V AC & DC, 0–100mA DC and 0–150k ohms. Get one for the glovebox and one for the home!
Cat Q-1010 **$12.50**

Here's a fantastic price for a 20,000 ohms per volt meter: 13 highly useable ranges, large, easy-to-read dial. It's a superb meter for the home handyman and hobbyist. Compare the price elsewhere!

$15.95 Cat Q-1020

Our biggest selling multimeter. It has 20 ranges plus dB scale, with sensitivity of 20,000 ohms per volt. Large, mirrored scale for zero parallax error. Takes banana plugs. Q-1024

$29.50

MAJOR DICK SMITH RESELLERS

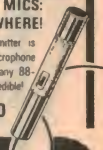
Listed below are re-sellers who stock a large range of our products. However, we cannot guarantee that they will have all items in stock or at the prices we advertise.

ADVANCED ELECTRONICS
5a The Quadrant, Launceston, Tas. (317 075)
AERO ELECTRONICS
123a Bathurst Street, Hobart, Tas. (346 232)
AMATEUR'S PARADISE
121 Norong Street, Southport, Qld. (322 644)
A & M ELECTRONICS
78a High Street, Wodonga, Vic. (244 588)
COASTAL ELECTRONICS
43 Vulcon Street, Moruya, NSW. (742 545)
COFFS HARBOUR ELECTRONICS
Shop 3, Coffs Harb. Plaza, Park Ave, Coffs Harbour. (525 684)
CRYSTAL TV RENTALS PTY LTD
66 Crystal Street, Broken Hill, NSW. (6897)
DECRO ELECTRIC
Cnr Megallan St & Bruxner Hwy, Lismore, NSW. (214 137)
ELEKTRON 2000
181 Wharf Road, Newcastle. NSW. (762 644)
ELECTROFIX
133 Malop Street, Geelong, Vic. (97 827)
GOODWIN ELECTRONICS
123 Station Street, Blackheath, NSW (878 379)
HAWKESBURY ELECTRONIC CENTRE
111 George Street, Windsor, NSW. (773 441)
HUNTS ELECTRONICS
18 Neil Street, Toowoomba, Qld. (326 944)
HUTCHESSONS COMMUNICATIONS CENTRE
5 Elizabeth Street, Mt Gambier, SA. (256 404)
KELLER ELECTRONICS
218 Adelaide Street, Maryborough, Qld. (214 559)
KINGSTON ELECTRONICS & RECORDS
Channel Court, Kingston, Tas. (296 802)
KB ELECTRONICS & MARINE
361 Main Terrace, Geraldton, WA. (212 176)
KENT ELECTRONICS
42 Stuart Highway, Darwin, NT. (814 749)
LYREBIRD ELECTRONICS
50 Berry Street, Nowra, NSw. (25 525)
MELLOR ENTERPRISES
Shop 2, Forsythe St, Whyalla Norrie, SA (454 764)
M&W ELECTRONICS
48 McNamara Street, Orange, NSW. (626 491)
NAMBOUR ELECTRONIC SHOP
Shop 4, Lowan House, Ann St, Nambour, Qld. (411 604)
ODYSSEY ELECTRONICS
101 Main Street Bairnsdale, Vic. (525 262)
POWER'N'SOUND
15 Frenklin Street, Traralagon, Vic. (743 638)
P.J. O'BRIEN ELECTRONICS
62 Wee Waa Street, Walgett, NSW. (243)
PURELY ELECTRONICS
15 East St, Rockhampton, Qld. (21 058)
SOUND COMPONENTS
78 Brisbane Street, Temworth, NSW. (661 363)
SUMNER ELECTRONICS
95 Mitchell Street, Bendigo, Vic (431 977)
STEVENS ELECTRONICS
42 Victoria Street, Mackay, Qld. (511 723)
SILICON CHIP ELECTRONICS
Suite 3, 98 Bridge Street, Muswellbrook, NSW
TABLELAND RADIO SERVICE
2 Jack Street, Atherton, Qld. (912 017)
TDMORROWS ELECTRONICS & HI FI
68 William Street, Gosford, NSW. (247 246)
TRILOGY WHOLESALE ELECTRONICS
40 Princes Hwy, Fairy Meadow, NSW. (831 219)
TROPICAL TV
249 Fulham Road, Vincent, Qld (791 421)
WAGGA WHOLESALE ELECTRONICS
82 Forsyth Street, Wagga, NSW 2650
VIKING ELECTRONICS PTY LTD
3108 Gold Coast Hwy, Surfers Paradise, Qld. (388 280)

LOOK MUM: NO WIRES! FM WIRELESS MICS: GO ANYWHERE!

FM Wireless microphone that clips to your tie or shirt, tiny transmitter slips into pocket. Great for PA, etc.
ELECTRET CONDENSER QUALITY
C-1073 **$29.95**

Or this one: the transmitter is completely within the microphone case. Receive them on any 88-108MHz FM tuner. Incredible!



C-1070 **$27.50**

BUYING BY MAIL?

It's so easy! Simply list the items you want, with their catalogue numbers, and post it off with your cheque to our mail order centre (address at right). Don't forget to include post & packing (charges apply to total order value as per table at right). Then watch your letterbox!

ORDER VALUE:	P&P
$5 (min) to $9.99	$1.00
$10.00 to $24.99	$2.00
$25.00 to $49.99	$3.00
$50.00 to $99.99	$4.00
$100 or more	$5.50

NOTE: These charges apply to goods sent by post in Australia only. Large and bulky items cannot be sent by post.
If you prefer, we will despatch your order by Comet Road Freight to anywhere in Australia for only $5.00 — that's below what it costs us! Large and bulky items are normally sent by Comet unless you specify differently (eg by rail or air — you pay freight on delivery.)

YES! WE HAVE THE COMPUTER MAGS:

Like Kilobaud, Byte, Creative Computing, Micro 80, etc (plus many of the overseas & Australian electronics mags which have computer sections!

AND THE NEW:

AUSTRALIAN PERSONAL COMPUTER $2.20 Cat B-5059

Packed with the latest in hardware, software, new computer developments, people, contests, ideas, etc etc! Great value for the micro enthusiast!

IT'S JUST ARRIVED!

THE NEW DICK SMITH SYSTEM 80 COMPUTER...

See pages 116 & 117 for more details!

NEW! DICK SMITH GUIDE TO SORCERER BASIC

B-6103 $9.95

Still in the dark? This book will turn on the lights!

Written exclusively for Dick Smith by computer programmers, this book really gets down to basics (no pun intended!) Like how to turn on your computer!

If you're buying a computer — or even thinking about one — this book is for you. While written with the Sorcerer Computer in mind, it's applicable to any computer using BASIC language.

EXCLUSIVE TO DICK

16K UPGRADE KIT: SAVE $30!

SUITABLE FOR ALL COMPUTERS!

Incredible bargain from Dick: Save a massive $30.50 on this pack of 8 4116 RAMs for upgrading your computer memory. YES! These are top quality 250nS types which are suitable for ALL microcomputers. We're buying so many of these that we get huge bulk buy discounts: & our savings are passed on to you. You reap the benefit. X-1186

~~$109.50~~ $79.00 INCLUDES INSTRUCTIONS

ALSO AVAILABLE: Individual 250nS 4116 RAMs, also at a huge saving. Buy at Dick's low bulk prices and save! Cat Z-9310 ~~Were $14.40~~ $9.90

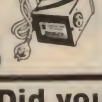
WORD PROCESSOR KEYS FOR SORCERER

11 special red keytops with word processor legends embossed on them, to replace the numeric keypad keys when using the Sorcerer as a word processor. Makes remembering the word processor functions so much easier!

$14.95 SET OF 11 Cat X-3086

COMPUTER MAINS FILTER

Don't lose that important program through mains spikes! This filter removes the gremlins that come down the power cord which cause programs to crash! A necessity for serious computer users! Cat M-9850



$75

SAVE OVER 20% ON FAMOUS TRIO HOBBYIST CRO!

Full 5MHz bandwidth, 10mV per division sensitivity and a sweep frequency range from 10Hz to 100kHz in four ranges make this the ideal CRO for hobbyist use.

But be quick, because we've only got a few of these left — so ring your nearest store to check stocks. Cat. Q-1230

WAS $279.50 NOW $199.00 SAVE $80.50

BELOW COST! LIMITED STOCKS!

MODEL CO-1303D

SEE OUR HI FI SHOW: NOW ON AT YOUR NEAREST DICK SMITH STORE

DON'T WAIT FOR THE HI FI SHOWS: COME AND SEE DICK'S! ON 52 WEEKS OF EACH YEAR: NO ADMISSION CHARGE!

SPEAK'N'SPELL IS BACK!

A lot of customers have missed out on the Speak & Spell talking game. A lot of people have been disappointed! Now they're back: but hurry, stocks are still not as good as we would like them to be! The Speak & Spell is a great aid to teaching your children letter construction and spelling. It uses a special microprocessor IC to synthesise speech electronically: no tape recordings!

NOW THE SPEAK & SPELL IS EVEN BETTER!

Three new plug-in modules to extend the Speak & Spell's vocabulary and give it more interesting variations:

Vowell Power (X-1305)
Super Stumper 1 (X-1301) $17.95 each
Super Stumper 2 (X-1302)

$79.50 Cat X-1300

MANUFACTURERS WHOLESALE USERS RETAILERS

Dick Smith Electronics is now able to supply OEM and wholesale quantities of professional quality 1% tolerance metal film resistors: that's right, 1% tolerance, high stability, low temperature coefficient metal film resistors. And the price is what you'd expect to pay for inferior carbon types: from

5¢ each

in 100 up quantities! Want to know more? Give us a call on Sydney (02) 888 3200.

INTERCOM TELEPHONE PICKUP

Easily fits to your intercom, phone, etc by a suction pad. Inductive pick-up allows amplification, recording, etc. Complete with 1 metre lead and plug. Cat C-7300

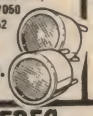
$1.50

ULTRASONICS

Need ultrasonic transducers for the magazine projects (see this month's ETI)? We've got em: matching ultrasonic transmitters and receivers for a huge range of projects. (They're fun to experiment with, too!)

Transmitter: Cat L-7050
Receiver: Cat L-7052

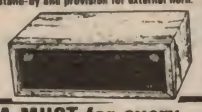
$6.95 ea.



ULTRASONIC ALARM

Neat and unobtrusive, this alarm module looks like a small speaker enclosure. It sends out invisible ultrasonic waves: any movement in their path is reflected back and detected as an intruder. For home, for business: you really can't afford NOT to have some form of burglar protection these days. This system gives you one of the best types: fully self contained, mains operated with battery stand-by and provision for external horn.

$99.00 L-5108



DICK'S ZIPPYS ARE BEST

Dick Smith Zippy Boxes are unique: they're the ones with slotted sides allowing for easy mounting of pcb's, etc. Insist on them!

SIZE:	Cat No:	1-9	10 up
150x90x50	H-2751	$2.50	$2.00
196x113x60	H-2752	$3.75	$3.00
130x68x41	H-2753	$1.95	$1.60
85x54x28	H-2755	$1.50	$1.20

STEREO HEADPHONES

Comfortable fully padded phones at a true budget price. Adjustable headband and lightweight ensures hours of stereo listening pleasure. Complete with lead and plug.

$9.75 C-4100

A MUST for every hobbyist!

Do you suffer burnt fingers when soldering PCB's? Your troubles are over: this unique soldering stand holds the PCB, soldering iron, solder, etc — giving you a hands-free job made easy! Try it — you'll agree! Cat T-5700

$19.50

HI POWER HANDHELD!

Don't get caught in an emergency! This compact high power unit is ideal for hikers, fishermen, construction workers etc. Provides 6 channels (one fitted with marine emergency 27.880MHz). Maximum legal input is 5 watts - plenty of power for long distance communications! Comes complete with case, strap, earphone and instructions.

XTALS FOR ALL CHANNELS IN STOCK NOW!

$99.50 Cat D-1120

HI SIDE XTALS FOR 27MHz TRANSCEIVERS

Eliminate 'image' interference on marine frequencies from CB radios & paging units etc. RECEIVE XTALS NEEDED ONLY:

D-8120	27.24	27.895
D-8123	27.88	28.335
D-8124	27.89	28.345
D-8125	27.90	28.335
D-8128	27.91	28.385

ONLY $5.00 EACH!

NEW MARINE XTALS:

Yes, we've got the crystals for the new 27MHz marine channels. receive/transmit pairs plug straight in:

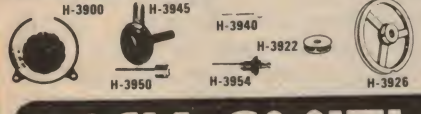
27.860 (Cat D-6086)
27.940 (Cat D-6094)
27.96 (Cat D-6096)

$5.00 pr.

HOBBYISTS...Did you know?

WE STOCK A WIDE RANGE OF PARTS TO HELP YOU COPE WITH A VARIETY OF CONSTRUCTION PROBLEMS.

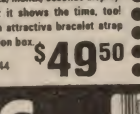
VERNIER DIAL High quality for precision tuning	H-3900	$4.90
PLANETARY MECHANISM 5:1 Ratio	H-3945	$4.50
DIAL DRIVE SPINDLE Has 6.3mm shaft	H-3954	$1.50
EXTENSION SHAFTS 6.3mm to 51mm	H-3950	$1.30
DIAL DRUM 51mm diam. around dial drum	H-3926	90¢
BRASS DIAL PULLEYS 9.5mm dia. 3mm	H-3922	19¢
DIAL CORD Spool approx. 25 metres	H-3934	$2.30
DIAL SPRINGS RGS Universal	H-3940	20¢



HF & VHF ANTENAS BY YAESU

How's this for a system: You buy the gutter mount & 2m stub and you're on the air on 2m. Then, as you want them, buy the HF band resonator/whip and you're on HF! Incredible value from Yaesu!

RSE-M-2 GUTTER MOUNT	$32.50	D-4100
RSE-2A 2m stub	$10.95	D-4102
RSL-145 6m/2m Antenna	$23.95	D-4104
RSL-3.5 80m Antenna	$21.95	D-4110
RSL-7 40m Antenna	$20.95	D-4112
RSL-14 20m Antenna	$20.95	D-4114
RSL-21 15m Antenna	$20.95	D-4116
RSL-28 10m Antenna	$20.95	D-4118

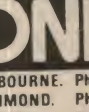


WATCH IT! LCD WATCH KIT

Here's a liquid crystal display watch you actually build yourself! Yes: Incredible integrated circuit watch technology comes to the hobbyist. It's a great gift idea for anyone with a technical 'bent'! function, complete with strap.

$17.50 K-3457

SUPER CHRONO WATCH!



Compare our price! This incredible watch has the lot: and it's under $50.00! Alarm (of course!), stop watch with split & lap timing, day/date/month/seconds display. Almost forgot: it shows the time, too! Complete with attractive bracelet strap and presentation box. Cat X-1044

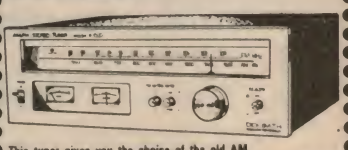
$49.50

● 30W/CHANNEL ● TWIN VU METERS

Superb quality amplifier gives you performance at a budget price. Featuring twin VU meters and 30 watts per channel output, with complete facilities for the most discerning hi fi buff. Was selling for $249.00 back in '79!

$199 Cat A-1300

FM IS HERE! HOW ABOUT AN AM/FM TUNER?



This tuner gives you the choice of the old AM stations or the brand new FM stations! Matches perfectly with the above amplifier to give you a system that's hard to beat. Large, illuminated meters give positive, accurate tuning indication. FM muting kills inter-station hash. Was selling for $189.00 in 1979. Now look!

$159 Cat A-1500

AND A DOLBY DECK

Reviewed by Electronics Today magazine and rated as 'outstanding value for money . . .' This model is the new, improved version with a damped cassette lid and auto stop. And, of course, Dolby™ noise reduction, giving you performance normally found only on decks costing much, much more! This superb deck makes the Dick Smith audio system the best deal in hi fi you're going to find!

$169 Cat A-3500

TO FINISH YOUR SYSTEM Playmaster SPEAKERS

Everyone — even you — can afford to have quality sound reproduction with superb Playmaster speakers. Why are they so economical? Because YOU supply the labour. And putting them together is child's play: just a couple of hours work, with full step-by-step instructions provided. You'll be proud to tell your friends. I built them myself!

With Playmaster speaker kits from Dick Smith, you get the choice of three systems: 26 litre 3-way with 8 inch bass speaker; 53 litre 3-way with 10 inch bass speaker; and the superb 75 litre 3-way with a massive 12 inch bass speaker. Choose the system that best fits in with your requirements, your room size and your budget. There's something for everyone!

BUILD THEM YOURSELF AND SAVE!

8" system: $159.50 pair
10" system: $248.00 pair
12" system: $298.00 pair

(The 53 and 75 litre systems are also available in built up version for $101 pair extra)

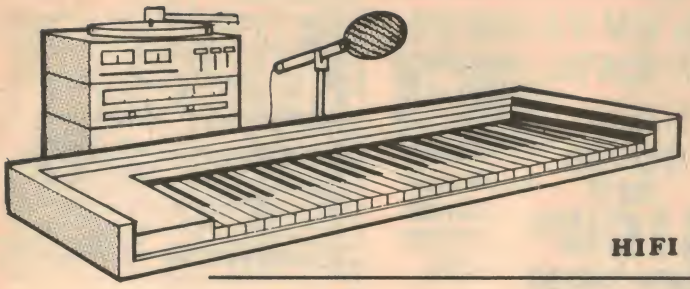
DICK SMITH ELECTRONICS

NSW	125 York Street,	SYDNEY.	Ph 290 3377
	147 Hume Highway,	CHULLORA.	Ph 642 8922
	162 Pacific Highway,	GORE HILL.	Ph 439 5311
	30 Grose Street,	PARRAMATTA	Ph 683 1133
	613 Princes Highway,	BLAKEHURST	Ph 546 7744
	263 Keira Street,	WOLLONGONG.	Ph 28 3800
VIC	399 Lonsdale Street,	MELBOURNE.	Ph 67 9834
	656 Bridge Road,	RICHMOND.	Ph 428 1614
QLD	166 Logan Road,	BURANDA.	Ph 391 6233
	842 Gympie Road,	CHERMSIDE.	Ph 59 6255
ACT	96 Gladstone Street,	FYSHWICK.	Ph 80 4944
SA	60 Wright Street,	ADELAIDE.	Ph 212 1962
WA	414 William Street,	PERTH.	Ph 328 6944

bankcard welcome here

SHOPS OPEN 9AM to 5.30PM (Saturday: 9am till 12 noon)
BRISBANE: Half hour earlier.
ANY TERMS OFFERED ARE TO APPROVED APPLICANTS ONLY
RE-SELLERS OF DICK SMITH PRODUCTS IN MOST AREAS OF AUSTRALIA.

MAIL ORDER CENTRE: PO Box 321, NORTH RYDE NSW 2113. Ph 888 3200. PACK & POST EXTRA.



LOUDSPEAKERS: Technics' response to a longstanding problem

For decades, loudspeaker manufacturers have been wrestling with the problem of producing loudspeaker cones that are, at the one time, durable and consistent, rigid, resonance-free and light in weight. Technics engineers claim that they have edged closer to the ideal with their new "honeycomb" cones, due to be released in Australia later this month.

by NEVILLE WILLIAMS

Virtually from the day they first made their appearance, moving-coil "dynamic" loudspeakers have been fitted predominantly with cones made from paper. Traditionally, they have been dyed black, as the appropriate thing to do, although AWA/MSP sought at one time to give their product eye appeal (?) with cones of bright yellow or bright green!

Somehow, they didn't look right.

The word "cone" is no accident: paper can offer a reasonable combination of rigidity and lightness only if it is formed into an appropriate shape. So that part of the loudspeaker which moves to agitate the air, and which might otherwise have been called the diaphragm, is more commonly referred to as the cone – a term that dates back to the pioneers Rice and Kellogg in 1925.

The manufacture of paper cones has been characterised by endless debate, as well as by "secret" processes, but certain things are self-evident.

If a driver is to perform well in the bass region, its cone has to "pump" a lot of air. It needs either to be of large diameter or else of smaller diameter but capable of moving freely to and fro – typically up to 3 to 4mm either side of its rest position.

Accordingly, the cones in bass drivers (or "woofers") tend to be thicker than normal and capable of acting as a pump or "piston" over the bass range and up to at least a few hundred Hertz. The central "spider" and outer surround have to cope with the substantial movement but fortunately, at these lower frequencies, a bit of extra weight does not matter too much.

At the other extreme, high frequency "tweeters" need to have small, lightweight cones if they are to operate efficiently up to at least 15kHz.

Mid-range drivers fall midway between these two extremes and, if you examine typical three-way loudspeaker systems, the basic and differing needs will be seen to have been met.

Not surprisingly, so-called "full-range" loudspeakers pose a real headache for designers, the first problem being obvious: somehow, they have to contrive a cone voice coil suspension system which is rugged enough to handle low frequency energy and yet light enough to reproduce very high frequency signals.

A further problem is more subtle: at drive frequencies approaching (and beyond) 1000Hz, where the wavelength diminishes towards (and below) the cone dimensions, it (the cone) begins to buckle and vibrate in various modes across its surface. This can cause peaks and troughs in the response, increased waveform distortion, and even audible buzzes extraneous to the program.

In an attempt to forestall this kind of cone "break-up" even in limited range drivers, designers often mould annular grooves into the cone, which decouple sections of the cone from each other. At the higher frequencies, only the central segment of the cone may vibrate. At progressively lower frequencies, a greater cone area is driven by the voice coil.

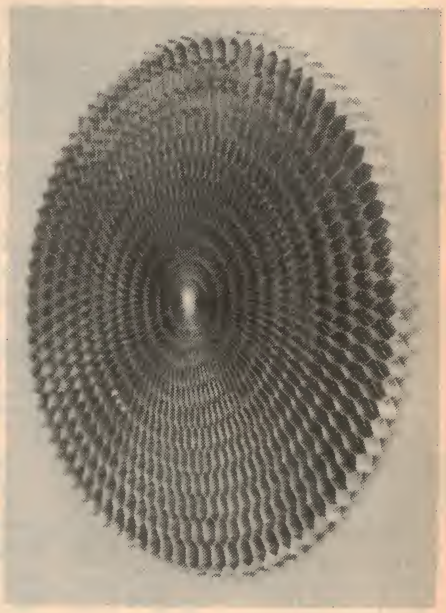
And here we move into the area of argument, debate and dark secrets: The number and detail of the decoupling rings; the possible use of radial stiffeners; the texture of the cone material; its weight and stiffness; its surface hardness; the enclosed angle of the cone; the possible resort to "curvilinear" shape . . .

And so on, ad tedium!

Perhaps it is sufficient to say that, over the years, we have seen just about every conceivable kind of paper cone, from one extreme to the other: what look like "cheapie" cones folded from flat, likely-looking paper and glued, seam and all, to a voice coil former and an outer support ring. But there have been others lovingly (and expensively) moulded from selected fibres in a process reminiscent of a fine felt hat! In many such cases the description "paper" may do the product less than justice.

There have also been notable efforts to escape the "paper" syndrome altogether – although the very persistence of conventional cones must be some tribute to their practicality.

In the 1930s, if memory serves me cor-



This very light aluminium core is the heart of Technics' new honeycomb disc flat diaphragm. The nominally hexagonal cells compress towards the centre to provide effective axial symmetry.

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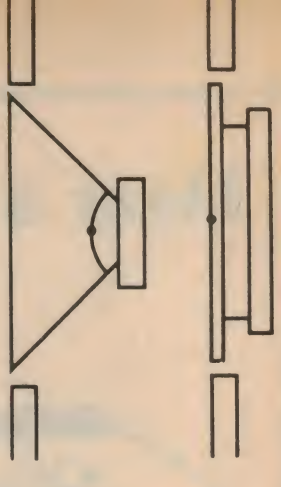
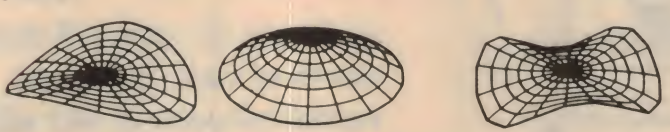
The thinking behind the honeycomb disc loudspeaker —

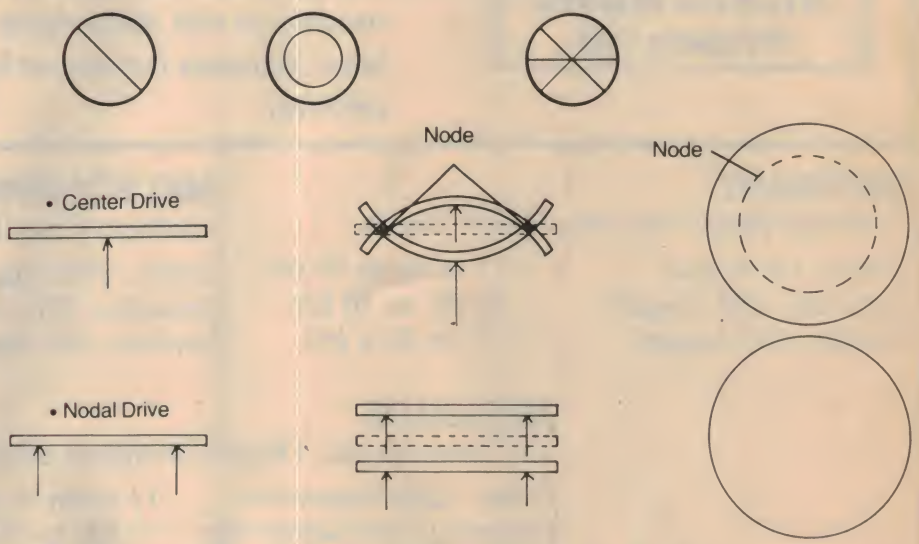


With flat drivers (far right) the acoustic centres (dot) can be aligned by mounting the drivers flush with the baffle. Conventional drivers have to be staggered for a linear phase relationship, necessitating a stepped enclosure.

Four of at least 10 significant vibration modes for a centre-driven square plate, as revealed by computer simulation. The modes (l to r) are at about 2.7, 2.8, 3.0 and 3.4kHz.



Above: Three of about eight significant vibration modes for round cones and, below, typical node lines involved. The frequencies (l to r) approximate 0.76, 1.3, 1.7kHz.



Vibration modes in diaphragms can be minimised by applying drive across the whole surface but this is really not practical in a heavy duty dynamic driver. Technics say that, by applying drive at a selected node region, one major vibration mode can be eliminated and others significantly reduced in amplitude.

rectly, the late Fritz Langford-Smith (editor "Radiotron Designers Handbook) imported a then new (I think) Hartley-Turner full-range driver. Unlike other hifi loud speakers of the day, it had a hard, brown bakelised cone and unusually soft suspension. On sinewave input, it sounded uncannily clean but it seemed to "muddy up" badly on complex musical passages.

Unfortunately, before we had the chance to work out what might be wrong, someone got the leads confused and plugged it into 240V AC. And that was that!

In Britain, GEC produced an eight-inch bass driver with a cone of shim brass. This seemed to make quite a name for itself, particularly in association with its companion tweeter.

Philips experimented with cones ("pistons"?) made of thick polystyrene foam and one 12-inch woofer at least received a good deal of attention at the time.

The Leak "Sandwich" driver also used a polystyrene cone but was faced with aluminium foil.

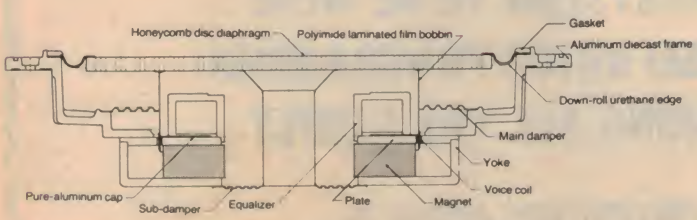
Currently – and for the past 10 years or more – KEF drivers have also used multi-layer cones, referred to in their literature as "Bextrene". Their highly regarded B-139 bass driver, and its closely related passive radiator, both use a wedge-shaped flat-faced diaphragm moulded from polystyrene foam and surfaced with blackened aluminium foil.

As a manufacturer of loudspeakers on a very large scale, the Matsushita group (Technics/National/Panasonic) have probably looked at cones as closely as anybody. They have certainly been well aware of cone "break-up" (or standing-wave) problems, as revealed originally by rather primitive methods and, more recently, by strobe and laser technology, or by computer simulation.

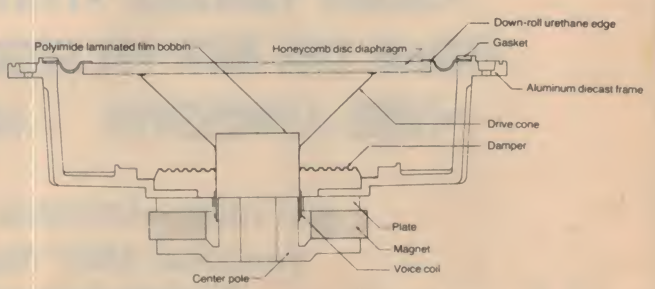
Two other problems have been looked at – amongst others:

(1) The interaction between pressure waves radiated from the inward sloping surfaces. Cancellation and summing produces minor peaks and troughs across the upper end of the spectrum. Technics refer to the behaviour as "front cavity effect".

(2) The need to determine the "acoustic centre" of woofer, squawker and tweeter cones and to stagger the drivers



A cross-sectional diagram of the new Technics SB-10 system woofer, which uses a 32cm dia honeycomb disc diaphragm, directly driven by a 16cm dia voice coil. The SB-10 is said to work comfortably to 3300Hz but it would normally be rolled off above about 400Hz in a typical, high quality three-way system.



In the SB-7 system woofer, a 25cm honeycomb disc is driven via a specially rigid cone cemented at the nodal diameter.

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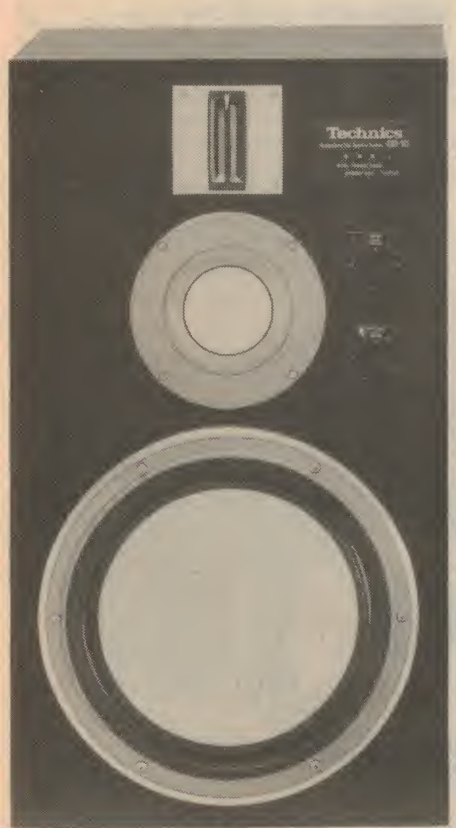
accordingly, in order to achieve linear phase characteristics. This can add to enclosure cost and increase the number of corners and edges, with possible undesirable diffraction effects.

Motivated by such considerations, Technics engineers turned their attention to the possibility of producing a line of flat diaphragm drivers. These could hopefully exhibit a flatter frequency response and, as well, offer linear phase characteristics when mounted directly on the front of a normal rectangular enclosure.

In a classical example of "sideways thinking", Technics turned away from traditional materials like paper and foam derivatives and turned instead to the aircraft industry. Here the need for light, rigid, relatively plane surfaces is commonly met by a honeycomb structure – a sandwich of (typically) hexagonal cells between two plane surfaces.

With loudspeaker diaphragms in possible view, Technics research showed that, weight for weight, an ultra-light aluminium honeycomb sandwich offered an inherent bending stiffness 700 times that of plane aluminium sheet and 1000 times that of Kraft paper. Its potential for use as a flat diaphragm seemed obvious.

However, it became apparent that a honeycomb sandwich did not necessarily exhibit even stiffness along all stress lines and this seemed to be an undesirable characteristic in something that was to be used as a loudspeaker diaphragm.



The Technics SB-10 system uses a 32cm honeycomb disc woofer, an 8cm honeycomb disc mid-range and a "leaf" tweeter with crossovers at 400Hz and 4000Hz. Power rating is 100W DIN or 150W music, and response 28Hz to 125kHz!

Further study was made also of possible diaphragm shapes and this involved a re-examination of vibration modes in square diaphragm, as originally set down in 1909 by the German physicist Walter Ritz.

Technics choice ultimately reverted to a flat, circular diaphragm, of diameter appropriate to the role of the driver, and using what they describe as an "axial symmetry" core. As will be apparent from the photograph, the core is made up from concentric rings of "hexagons" which are progressively flattened as the diameter diminishes towards the centre.

The choice of a round cone was conditional, so they say, on their ability to apply drive in such a way that it would tend to minimise, rather than to excite vibration modes which would be evident to some extent, even in a disc of honeycomb structure.

Drive applied across the whole surface would have been ideal but it would not have been a practical method for a complete range of drivers. By contrast, centre drive to a disc diaphragm is the least desirable mode, because the entire surface is available to accommodate the maximum number of modes.

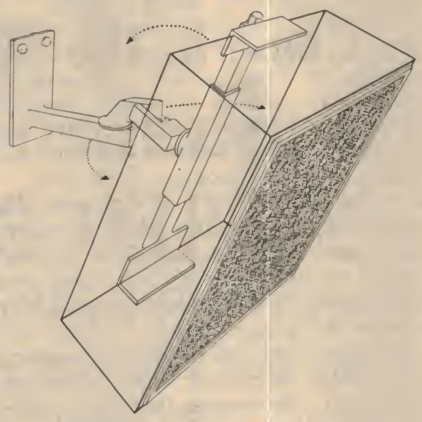
What Technics engineers did was to study the significant vibration modes for the various sizes of diaphragm and identify the nodes – those areas which tend to remain stationary while the rest of the panel is vibrating. By applying drive in a selected nodal region, they claim that vibration modes (or "break-up") is substantially inhibited. Further that the range over which the diaphragm will act as a piston can be extended by a couple of octaves.

In the case of the new 32cm woofer, this meant fitting it with a voice coil of no less than 16cm to secure the desired "Nodal" drive. A voice coil, so large in relation to the diaphragm, poses special problems in relation to the coil itself, to the magnet structure and, indeed, to the whole configuration of the driver. However, Technics are confident that consumer reaction will prove that their pioneering has all been very worthwhile.

Four of the systems in the new Technics "Honeycomb" range are due to be released in Australia around the end of this month.

Wall mounting for speakers

Pivotelli multi-directional audio-visual wall brackets can provide a new and practical answer to a familiar furnishing problem in small rooms: hifi speakers or TV receivers can be suspended unobtrusively from walls and angled to suit listening or viewing needs.



The distributors, Associated Steel Equipment Pty Ltd, say that Pivotelli brackets can be obtained to fit equipment from about 18cm to 125cm in width and will support weights up to 110kg. They are available with multiple horizontal pivots and vertical tilt and are made of high grade solid steel, nylon coated in either black matte or gloss white. The brackets are the subject of a London Design award.

Two kinds of base plate are available, to suit differing equipment needs — either clamp types or screw types.

In terms of utility, the distributors say that, not only can the loudspeakers, TV, etc be angled for best results, but that the need for stands trolley or shelves is eliminated, leaving the floor space uncluttered and simplifying cleaning. With proper planning, trailing leads can also be hidden.

The set-up illustrated is just one of a number depicted in a brochure available from the distributors, some being smaller and simpler, others larger and more complex.

It is evident also that they have a wide-ranging potential for use in commercial, industrial, educational — even medical situations. Applications which have already emerged from their relatively short exposure in Australia incude hifi and sound equipment, TV and other audio visual units, video recorders, microwave ovens and heart monitors.

For further information, price lists, etc, contact Associated Steel Equipment Pty Ltd, 11 Hornscroft Place, Moorabbin, Vic 3189. Telephone (03) 95 9355, 95 9921.

AUDIO ELECTRONICS – continued

The SB-3 is a two-way system combining a 22cm honeycomb woofer and a 2.8cm honeycomb tweeter, with attenuator control. Dimensions are 27 x 44 x 23.7cm (WxHxD) and power rating 75W music, 50W DIN. Response is quoted as 45Hz to 35kHz (–10dB).

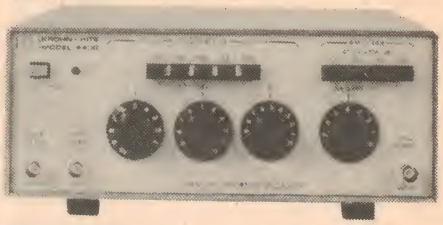
The SB-5 is a larger system (31.5 x 58 x 31.8cm) with an 8cm honeycomb disc mid-range driver added, also with its own level control. Crossover frequencies are at 800Hz and 4500Hz and response 38Hz to 35kHz (–10dB). Power rating is 110W music and 75W DIN.

In the SB-7 a 25cm honeycomb disc woofer is used, plus an 8cm honeycomb disc mid-range driver, and the Technics "Leaf" tweeter. This last has a flat ultra-lightweight diaphragm with overall drive, rather like a super-power "ribbon" configuration, and with a claimed response to 125kHz! As before, level controls are provided. Dimensions are 36 x 63 x 31.8cm, response 34Hz to 125kHz, and power rating 130W music and 90W DIN.

Big boy of the present range is the SB-10 with the same mid-range driver and leaf tweeter (and level controls) but with a 32cm honeycomb disc woofer. Dimensions are 40.2 x 71.1 x 31.8cm, response 28Hz to 125kHz, and power rating 150W music and 100W DIN.

In all cases, the drivers are mounted on the front face of a stoutly built rectangular enclosure and line up to provide a linear phase relationship.

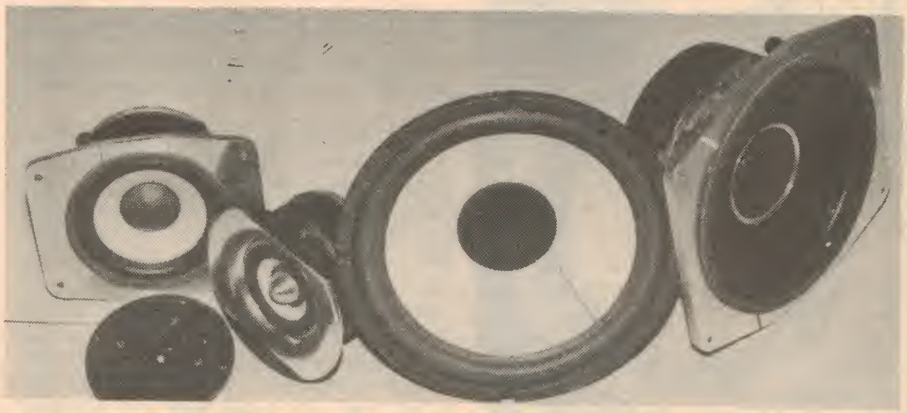
PEERLESS OF DENMARK have released two horn-loaded tweeters intended for use in high quality sound reinforcement systems. The LK10HT has a sensitivity of 95dB for one watt at one metre. For the K010HT the figure is 99dB. Both can be used with 50W systems when crossed over at 1500Hz, 12dB/octave. They can be used in 100W systems with a 4000Hz crossover. The manufacturers claim that their "soft dome" design ensures smooth response, low distortion and low colouration. For information on these and other Peerless drivers, contact G.R.D. Group Pty Ltd, 698 Burke Rd, Camberwell 3124. Tel: (03) 82 1256.



Pictured above is a new Krohn-Hite ultra low distortion audio oscillator. Listed as model 4400, it covers the range from 1Hz to 110kHz with sinewave output having a distortion level of less than .001%. Output is level at 7V RMS to within .05dB and attenuation is available to 90dB. Details from any Warburton Franki office.

MAGNAVOX (AUST) PTY LTD have just celebrated 50 years of manufacturing loudspeakers in Australia. Plans are in hand to upgrade marketing activities, with new models for high-performance car stereo and for do-it-yourself hifi enthusiasts. A catalogue is in preparation, together with distinctive merchandising packs. For information: G. K. Barter, Magnavox (Aust) Pty Ltd, 6-12 O'Riordan St, Alexandria, NSW. Phone (02) 699 4506.

French speakers from L.S.T. Electronics



In a noteworthy move, a company in Tamworth, NSW is importing a range of SIARE loudspeakers and ancillary components from France. The range – some of which are pictured above – includes 310mm and 244mm sub woofers, 244mm and 204mm woofer/mid-range drivers, various full-range and mid-range drivers and tweeters. Crossover networks are available to suit recommended combinations, plus appropriate enclosure details. For information on the SIARE range of loudspeaker products, contact L.S.T. Electronics, 374-378 Peel Street, "Centrepoint", Tamworth, NSW 2340. Telephone (067) 66 2525.

NEW LINES FROM M. R. ACOUSTICS

The letters QED once appeared at the foot of geometry theorems; nowadays, they are more likely to be associated with a range of hifi supportive products, exported from Britain and sold in Australia through M.R. Acoustics of PO Box 165, Annerley, Qld 4103.

One such product is aimed at the enthusiast who watches despairingly as the acrylic cover of his prized phono deck becomes scratched and dull. It tends to take the shine off his whole system!

The QED Dust Cover Renovator Kit contains a tube of white paste – presumably a very fine abrasive – and two applicator cloths, which can be used to polish out the scratches. Instructions on the box warn that the operation might have to be repeated several times in the area of deep scratches. We imagine that that would be putting it mildly – the lesson being that carelessness with an acrylic dust cover will bring its own dubious reward, either in the form of an ugly scratch or a lot of work to get rid of it!

Whether or not the scratch is removed completely, a container of liquid polish and a lint-free cloth should make the cover glisten anew. The polish is also said to render the acrylic less liable to pick up electrostatic surface charges.

As a matter of interest, the instructions suggest that the treatment can be used on things like watch "glasses". We took them at their word and, within a couple of minutes, the much abused glass of the writer's watch became positively transparent again!

Price of the renovator kit is quoted as $13, for which outlay it should be possible to refurbish several dust covers.

The second item pictured is a five-metre length of very heavy gauge twin flex, which QED (and M.R. Acoustics) recommend as low-loss loudspeaker cable. Appropriately, they make no fancy claims about it being a "super" cable, but they do point out that it has 79 strands, giving a 20-amp rating, with a DC resistance of 0.0076 ohms/metre and a capacitance of 90pF/metre. As such, it would introduce negligible loss in any likely domestic installation, while the modest capacitance should not upset any ordinary amplifier.

A slight ridge down one side of the cable allows the conductors to be identified without electrical measurement.

The cable is priced at $10 per five-metre length or $185 per 100-metre roll.

Other lines mentioned in recent literature from M. R. Acoustics include:

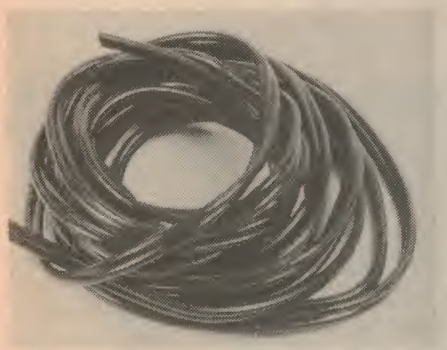
BERKSHIRE AUDIO: Equipment devised by this American company, and stocked by M. R. Acoustics, can measure the capacitance of phono arm/cable combinations and ensure that an optimum R/C match is obtained with a given cartridge.

WESTRAK CARTRIDGE: Model 501 is a moving coil type manufactured in Japan for Howland West of the UK. It weighs a modest five grams and offers a nominal output of 3.5mV – sufficient to drive a normal amplifier directly. Price is $280.

TURNTABLES & ARMS: The JH turntable combines economy and simplicity with good performance at $48, plus $24 for a perspex cover. Build your own plynth. The JH arm sells for $98 and SONUS cartridges from $65 up.

Inquiries may be directed to M. R. Acoustics at the address given above. They are accessible by phone: (07) 48 7598 or (07) 284 6764. (WNW)

The QED Dust Cover Renovator kit (right) is supplied in a polystyrene pack and cardboard sleeve. Pictured below is a 5m length of heavy duty cable well suited for loudspeaker connections.



Technics SL-10 phono player

Technics has taken a most unusual approach with this new SL-10 turntable. It has a linear tracking tonearm built into the lid which must be closed for normal operation. The tonearm is dynamically balanced and can play in any attitude, even vertically. But perhaps the most dramatic and most noticeable feature of the Technics SL-10 is its small size — it is not much larger, in plan, than an LP record sleeve.

While there is a vast range of turntables on the Australian market, most conform to fairly conventional design principles. As a result, there are a great many look-alike turntables with little to separate them in terms of styling or performance. This can certainly not be said of the Technics SL-10. It is easily the most radical development in turntable design that we have seen for many years.

In some ways, the SL-10 can be regarded as the disc answer to the cassette deck. For example, once the record is placed on the turntable and the lid closed, the user has no contact, at all, with the disc. The user plays the disc by remote control using the deck controls. We accept this as normal for playing cassettes but it is little short of revolutionary for discs.

This isolation of the record has a number of worthwhile advantages. First, the record is less likely to be exposed to dirt; the user cannot cough, sneeze or blow cigarette smoke over it. Second, the cartridge cannot be damaged by clumsy handling and third, because the record is played in what is virtually a sealed chamber, there is less likelihood of direct acoustic feedback from the loudspeakers.

As shown by the photograph on the second page of this review, the compact SL-10 player opens into two halves. The lower half naturally contains the turntable platter and its direct-drive motor and accompanying circuitry. The upper half, the lid, contains a motor-driven linear tracking tonearm plus its control circuitry plus, on the top surface, the user controls.

When the record is placed on the platter and the lid closed, the disc is clamped in place by a rotor section attached to the lid. Pressing the "start" button on top of the lid will then initiate play. The miniature tonearm leaves its rest, moves over to the lead-in groove of the record and gently lowers the cartridge to the record surface. What is so different about this mode of operation from that of a conventional automatic turntable? Read on.

Whereas most automatic players do not sense the record size (the user does it instead), the Technics SL-10 senses the disc diameter by means of three radial groups of three infra-red LEDs (at least, we assume they are infra-red). Corresponding to these LEDs is a diagonal row of three photo transistors which, by a simple logic system, are able to determine the size of the record on the platter, ie, whether the disc is nominally 175, 250 or 300mm in diameter.

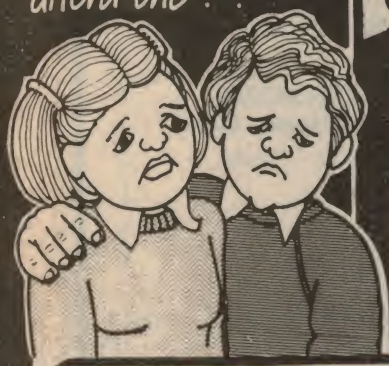
An optoelectronic system is also used to detect the deflection of the linear tracking tonearm so that tracking error is reduced to within ±0.1°. While this figure is very small, and is an order of magnitude less than the maximum tracking error of good quality conventional tonearms which is typically 2°, this is not the major advantage of a linear tracking arm. In truth, the distortion due to lateral tracking error is far less than the distortion inherent in typical cartridges.

No, the major advantage of a linear tracking arm is that it does away with the need for anti-skating compensation and its attendant compromises. Because the linear tracking arm produces no skating forces, the cartridge should have better tracking performance which should, in turn, translate to lower distortion.

Technics claim another advantage for their tonearm in stating that the player may be used horizontally, vertically or even upside down. This is true because the very short arm is dynamically balanced and has the stylus tracking force applied by a spring mechanism rather than a slightly out-of-balance counterweight.

But while it is true that the SL-10 will play in any attitude, it is not practical to use it in any but the horizontal mode. For a start, the SL-10 will not stand on edge in a stable manner and even if it was fixed in a vertical position it would not be practical. The not inconsiderable spring tension on the lid means that it flies open with such alacrity that the record is likely to end up on the carpet.

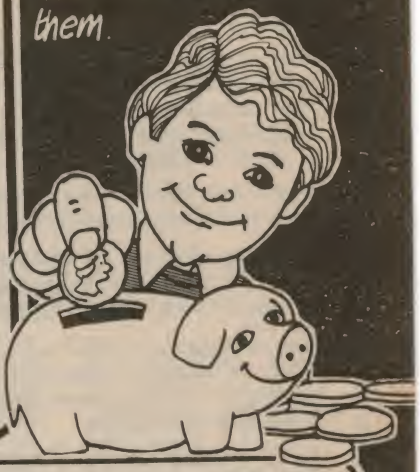
Ross and Sandra were feeling down. They wanted a good sound system but thought they couldn't afford one . . .



until they visited their nearest DICK SMITH STORE

& saw the fabulous PLAYMASTER SPEAKERS

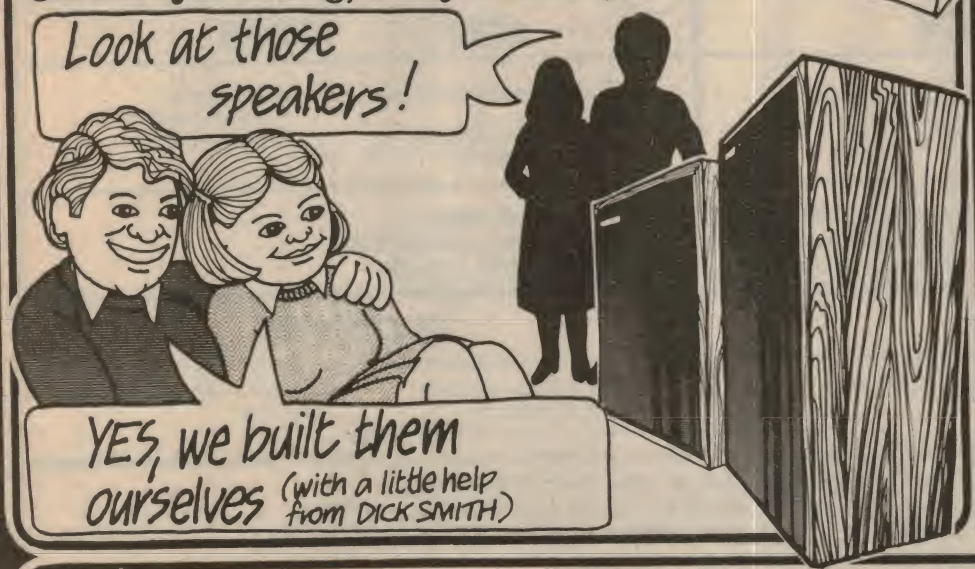
Ross worked out how much they would save and decided Playmasters were for them.



next saturday morning they collected their PLAYMASTERS

assembly was a cinch.

Saturday evening, Sally & George called



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Technics SL-10

So we'll just quietly forget about playing it vertically.

Perhaps the most elegant feature of the SL-10 player is the cueing system. This is controlled by three buttons on the lid. For example, if you are playing the outermost track and wish to play a selection further down the groove, pushing the Start button will raise the cartridge and cause it to traverse towards the centre of the record. At the same time, a red LED arrow lights up to show the direction of travel (just in case you cannot see the arm itself moving across in poor lighting).

Press the Start button just a little harder and the arm traverses more rapidly and two LED arrows light up. It happens very smoothly and very quietly. The same mode of operation applies for the other direction of traverse, by pressing the Stop button. Then, with the cartridge in the exact position desired, you can lower (or raised it) by pressing the Cue button.

Finding the exact spot on the record to cue the cartridge is not so easy. While there is an accurately marked scale which shows the precise position of the stylus with respect to the record centre (calibrated in millimetres), the scale is of little use when trying to line up the stylus by eye with the run-in groove for a particular track. To help this task, the perspex cover should have less tinting or the lighting of the record surface should be improved.

The SL-10 is supplied with a moving coil cartridge which is fixed directly to the tonearm. There is no separate headshell as such and the cartridge is not interchangeable with other models or brands. You can have any cartridge you want, as long as it is the Technics 310MC! This has a claimed frequency response of 10 to 60kHz or more realistically, within ±0.5dB from 10Hz to 10kHz. Channel separation is claimed to be more than 25dB at 1kHz and more than 20dB at 10kHz.

The performance results of the Technics SL-10 can be summarised by saying that the turntable itself performs very well but is let down by the cartridge. We found the turntable to operate flawlessly at all times. Rumble is very low and so is wow and flutter, which we measured at 0.02% DIN weighted.

As with most moving coil cartridges, the tracking performance of the 310MC cartridge is not up to the standard of good quality moving magnet cartridges. Tracking force of the cartridge is 1.25 ±0.25 grams. At the force set by the SL-10, 1.5g, the cartridge would not track the +12dB drum test track of the W&G 25/2434 disc and it was similarly below par on the CBS STR-110 disc.

Separation between channels of the cartridge was within the specification above. Frequency response was within ±0.5dB up to 10kHz as specified, using the internal preamplifier of the SL-10, but above 10kHz the response rises by 9dB to the resonance at 18kHz.

Waveform of the cartridge was also not up to the standard set by moving-magnet models. Whereas the latter types tend to show a slew-rate limiting phenomenon at the high frequencies (ie, the waveform becomes a sawtooth), the moving-coil 310MC waveform above 5kHz had high frequency ripples superimposed. Similarly, on square waves there was undamped ringing although at a relatively low level.

As is often the case with cartridges which do not turn in a good test result, the sound is quite passable although a little more strident than we would expect from a player in this price range.

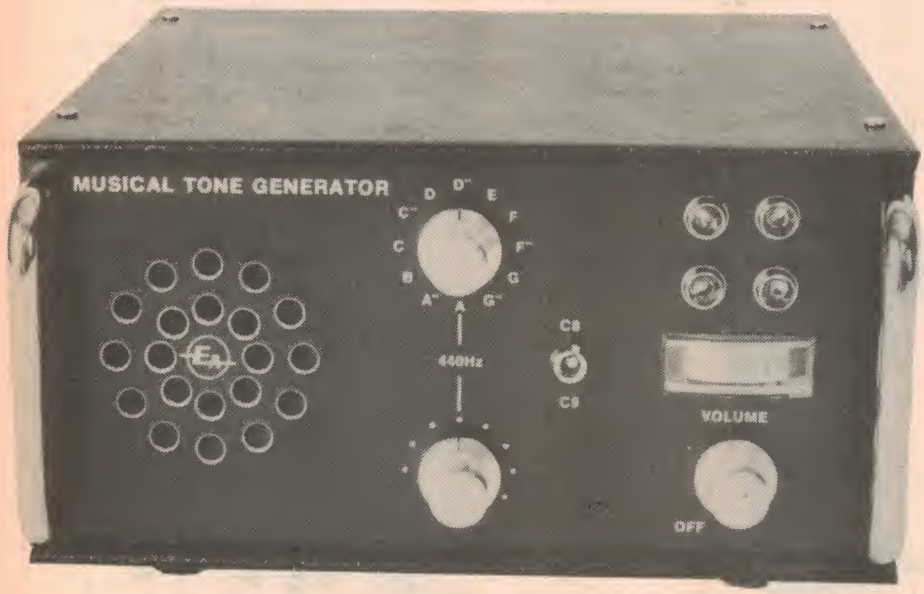
In short, the Technics SL-10 represents a new standard in turntable design but it would serve better with an improved cartridge.

Recommended retail price of the Technics SL-10 is $669 including sales tax. Further information can be obtained from hifi retailers or from the Australian distributors, National Panasonic (Aust) Pty Ltd, 95-99 Epping Road, North Ryde, NSW 2113, (LDS & JC).

Above is a close-up view of the very short tone arm assembly. The cartridge is fixed to the arm with a screw and is not interchangeable with other cartridges.

Musical Tone Generator

Crystal locked with beat frequency indicator



There are still large numbers of electronic organs with free running oscillators and which need tuning from time to time. This updated version of a crystal locked musical tone generator has a built-in beat indicator, thus avoiding the need for a CRO. The design may also form the basis for a synthesiser and for the generator for an electronic organ. With a built-in speaker, it may also be used to tune acoustically other musical instruments.

By IAN POGSON & GERALD COHN

As far back as July 1965 we described an Electronic Tuning Standard. By virtue of progress, this unit has long since been superseded. In August 1974 we described a Crystal Locked Musical Tone Generator. This was a giant step forward and indeed, it is still in current use.

However, we felt that the time had come to present an updated version of the latter unit. In retrospect, we considered that the latter unit had a couple of deficiencies which should be avoided if possible. For the normal tuning process, it was necessary to feed the outputs of the tuning device into a CRO, using the well known Lissajous pattern method. Also, when any acoustic tuning was undertaken, some difficulty was experienced due to the fact that the audio tones from the built-in speaker were substantially square waves.

Our new tuner was therefore to have some sort of built-in indicator and so avoid the need for an external CRO. Also, the tones should be filtered so as to approximate a sine wave, thereby making acoustic tuning adjustments easier.

A rather more important problem than those just mentioned, was the question of a suitable top-octave synthesiser IC consistent with a reliable source of supply. After giving this question careful consideration, we found that a suitable IC was available through the Tandy organisation. The IC is type 50240 and is available in a 16-pin DIL package.

A desirable feature of the 50240 is that it requires only a single polarity power supply, compared with the AY-1-0212 as used in our design of August 1974. The latter device requires −15V DC in addition to the +12V.

And so we had established the basis for our new version of the musical tone generator. All other components at the time of writing are readily available. More will be said about components and places of availability later on.

A look at the block diagram will show the general principle of operation. A 2MHz crystal oscillator drives the top-octave synthesiser. This divides the input 13 ways and by whole numbers to give the top notes required. These include two Cs, C8 and C9. Because whole numbers are used to divide the clock frequency, the resultant outputs are not necessarily precise but very closely approximate those laid down for the equal tempered scale.

S1, a single-pole 12-position switch, selects the required synthesiser output to be fed into a seven-stage binary counter/divider from which any one of eight octaves are available. C8 and C9, are selected by S3. The divider outputs are fed via eight low-pass filters to S2 which feeds the LED beat frequency indicator and the audio amplifier.

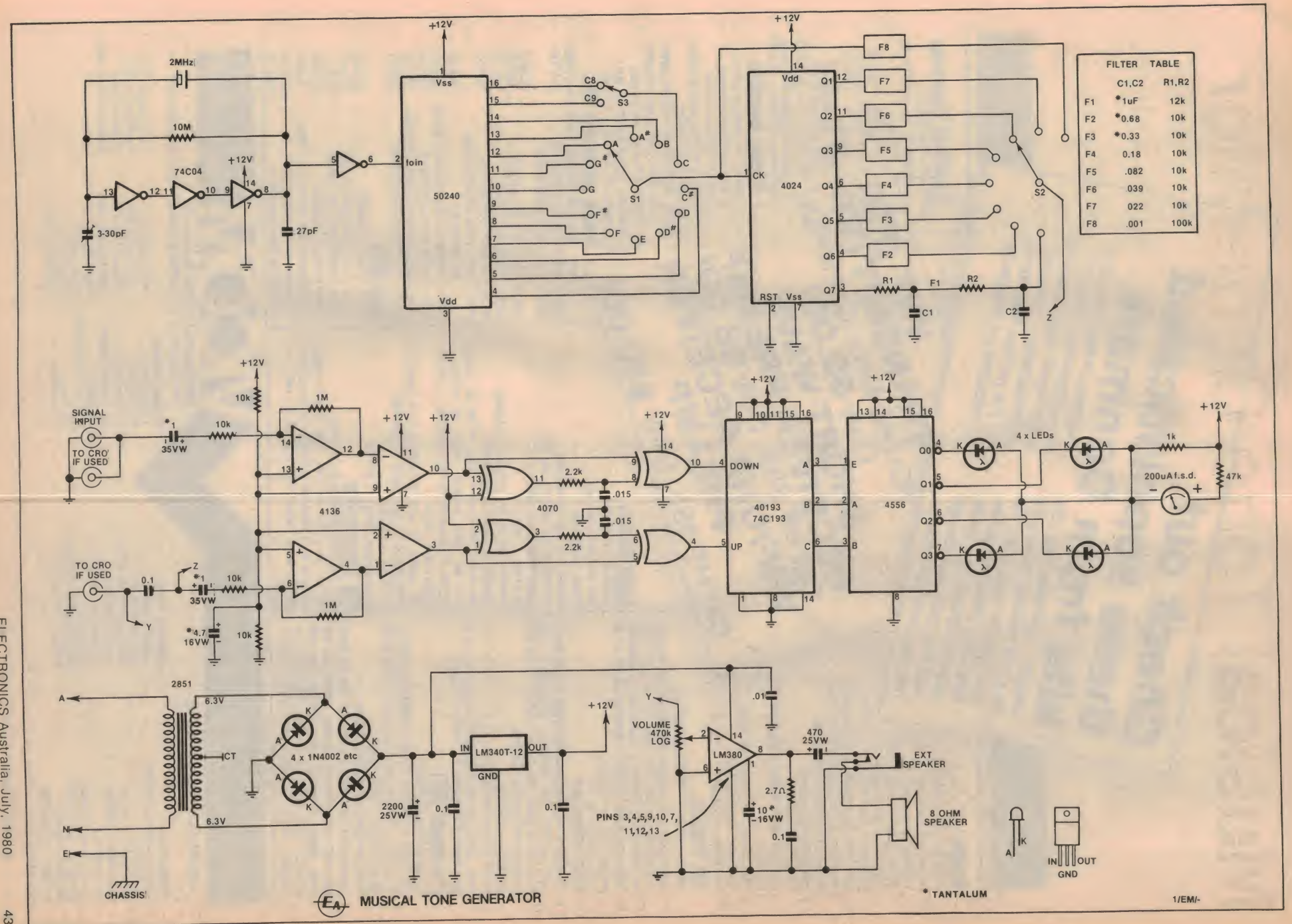
So far, we have referred to the crystal oscillator as being on 2MHz. This is a nominal frequency and much has been said about precisely what frequency should be used.

In addition to the tempered scale concept, we also have the matter of pitch to consider. This has been more or less universally accepted as fixing A above middle C on a frequency of 440Hz. The divisor of A on our top octave synthesiser is 284. Now if we divided 2MHz by 284, we get 7042.2535Hz. This is the frequency of the top available A for the instrument. Now if we divide this frequency down by octaves, we find that A is equal to 440.14082Hz, which is very close.

If we reverse the process, starting with 440Hz precisely, instead of 2MHz we get 1999.36kHz and this is the frequency required for the crystal for an exact A440.

If we adopt an exact A440, this will be coincident with the tempered scale requirement but it will be achieved at the expense of other notes being further removed from the tempered scale figures. Another school of thought seems to be that if a particular crystal frequency is adopted, giving a sort of "middle-of-the-road" for all notes of the scale, that this would be the best compromise. This crystal frequency works out to 2000.24kHz and when compared with the tempered scale figures, the maximum error is plus or minus .069%.

For the prototype, we fitted a 2MHz crystal and provided an adjustable trimmer in the oscillator circuit so that readers may make precise adjustments against a frequency counter or some other reference. We set our oscillator to 2000.24kHz. However, for average use the trimmer could be dispensed with and a 33pF NPO ceramic capacitor subsituted.


2MHz
10M
74C04
+12V
3-30pF
27pF
50240
Vss
Vdd
foin
4024
Vdd
CK
RST
Vss
Q1
Q2
Q3
Q4
Q5
Q6
Q7
F8
F7
F6
F5
F4
F3
F2
R1
F1
R2
C1
C2
S1
S2
S3
C8
C9
A
A#
B
C
C#
D
D#
E
F
F#
G
G#
Z
FILTER TABLE
C1,C2
R1,R2
F1 *1uF 12k
F2 *0.68 10k
F3 *0.33 10k
F4 0.18 10k
F5 .082 10k
F6 .039 10k
F7 022 10k
F8 .001 100k
SIGNAL INPUT
TO CRO IF USED
35VW
10k
1M
4136
4070
2.2k
.015
40193
74C193
DOWN
UP
4556
4 x LEDs
200uA f.s.d.
47k
1k
0.1
4.7
16VW
2851
6.3V
CT
4 x 1N4002 etc
LM340T-12
IN
OUT
GND
2200
25VW
VOLUME
470k
LOG
LM380
470
25VW
EXT SPEAKER
8 OHM SPEAKER
2.7Ω
10*
16VW
.01
PINS 3,4,5,9,10,7,
11,12,13
A
N
E
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Now let us look at the circuit and describe each section in detail. The crystal oscillator uses three inverters in a standard configuration which, by virtue of the propagation delay around the loop, prevents operation of the crystal in a spurious overtone mode. An additional inverter in the same 4069/74C4 package is used to buffer the oscillator output as it feeds into the 50240 top-octave synthesiser.

No buffering is required for the outputs of the 50240 as they are compatible with the following 4024 CMOS counter/divider.

Eight passive low-pass filters are used to change the square wave outputs from the 4024 to a rough approximation of sine waves. To save space, the component values for the filters are tabulated on the circuit diagram. Each of the filter outputs is selected by switch S2 and then fed to the audio amplifier and the beat frequency indicator.

The audio amplifier is simple enough. Output from switch S2 is coupled to the 470k volume control via a 0.1uF capacitor and thence to the LM380 14-pin amplifier IC. This drives a miniature loudspeaker or an external loudspeaker via a jack socket on the rear panel. Power output is about two watts maximum.

The beat frequency indicator employs four ICs and is based on a TTL circuit featured in our "Circuit and Design Ideas" pages from the January 1975 issue. What the circuit does is to give a revolving display of four LEDs. If the frequency being compared is higher than the standard generator frequency, then the LEDs will appear to rotate in one direction. If the frequency being checked is lower, the LEDs rotate in the other direction.

Finally, if the two frequencies are exactly the same the LEDs will stop rotating and extinguish.

This method of indication is very good in its own right but it does take time to make a precise adjustment, particularly at low frequencies. As there is a varying DC condition in the supply to the LEDs, a small meter has been added which follows the slow current changes which still exist at near to zero beat. Precise zero beat can be achieved very quickly by adjusting for a stationary meter needle.

Although we have provided an effective zero beat indicating system, some readers may have access to a CRO and may prefer to use it as the zero beat indicator. We have provided for this in that there are outlet sockets on the back of the case so that a pair of patch cords may be connected across to a CRO.

A 4136 quad operational amplifier IC is used to amplify the signals to a sufficient level to operate the following CMOS circuitry. All four op amps are referenced to +6V via a voltage divider comprising two 10k resistors. The output signal from S2 is fed to an op amp configured as an inverting amplifier with a nominal gain of 100. Following that is another op amp which is a comparator. The result of the gain of these two op amps is that the previously rounded signal from the output of S2 is amplified and squared up again. An identical pair of op amps similarly treats the external input signal. These squared-up signals are then fed to a 4070/4030 quad exclusive-OR gate which frequency-doubles both signals. The two output signals from the XOR gate are then fed to a 74C193 up/down counter. The processed external input signal is fed to the count-down input while the processed internal signal is fed to the count-up input.

The output of the up-down counter drives half of a 4556 two-to-four-line

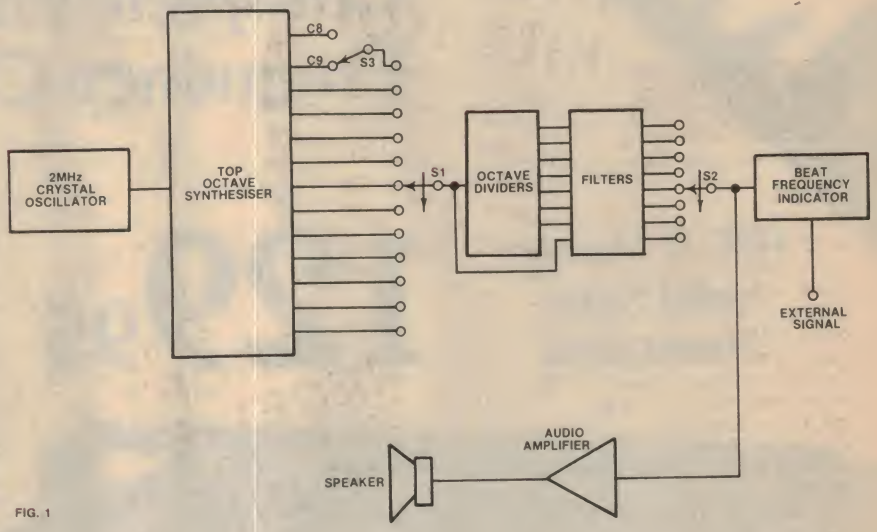
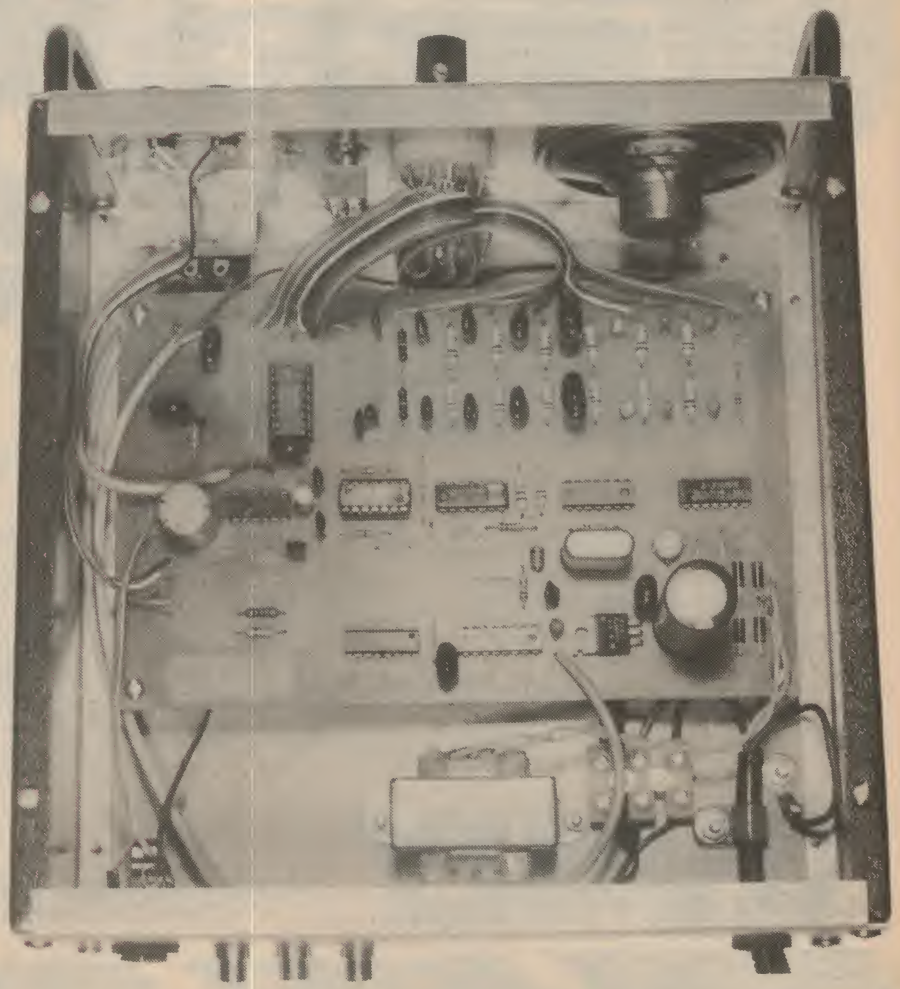


FIG. 1

This diagram shows the major features of the complete circuit which uses 13 ICs.



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This transceiver is designed for marine use. For example, the TRC-II is ideal for fishing/trawling vessels, motor cruisers, speedboats and houseboats. Mounting bracket can be secured to a horizontal shelf, the overhead or to a bulkhead. Features variable SQUELCH control to eliminate background noise. Automatic Noise Limiting Circuit (switchable), to reduce or eliminate impulse or static noise. Automatic gain control, to provide constant sound level. Push-pull Audio Amplifier to provide the highest quality sound reproduction. Modulation Indicator to let you know when you're transmitting. External SPK jack allows you to use an external speaker (8 ohms). The TRC-II is a reliable transceiver, with a great range in good conditions. 21-9141

Specifications

TRANSMITTER: Power Output 4 watts: Modulation 90-100%: Emission Type A3: Frequency Tolerance ±0.005%: Antenna Impedance 50 ohms (SO-239 receptacle).
RECEIVER: Sensitivity 0.7 uV for 10 dB (S+N)/N: Selectivity 6 kHz @ −6 dB: Adjacent Channel Rejection 36 dB: Audio Distortion at 1000 Hz 0.8 W 10% THD: Signal-to-Noise Ratio 40 dB: I.F. Frequency 455 kHz: Squelch-Adjustable from 50 uV to 3,000 uV
GENERAL: Channels — Supplied with A: 27.860 MHz B: 27.880 MHz C:27.900 MHz D:27.910 MHz E:27.940 MHz F:27.960 MHz: Power Requirements: 12.5—15VDC, negative ground only: Current Drain RX 0.3 A (full volume), TX1.2A (with modulation): Microphone-Dynamic with push-to-talk switch and coiled cable. 14 transistors, 9 diodes and 2 thermistors

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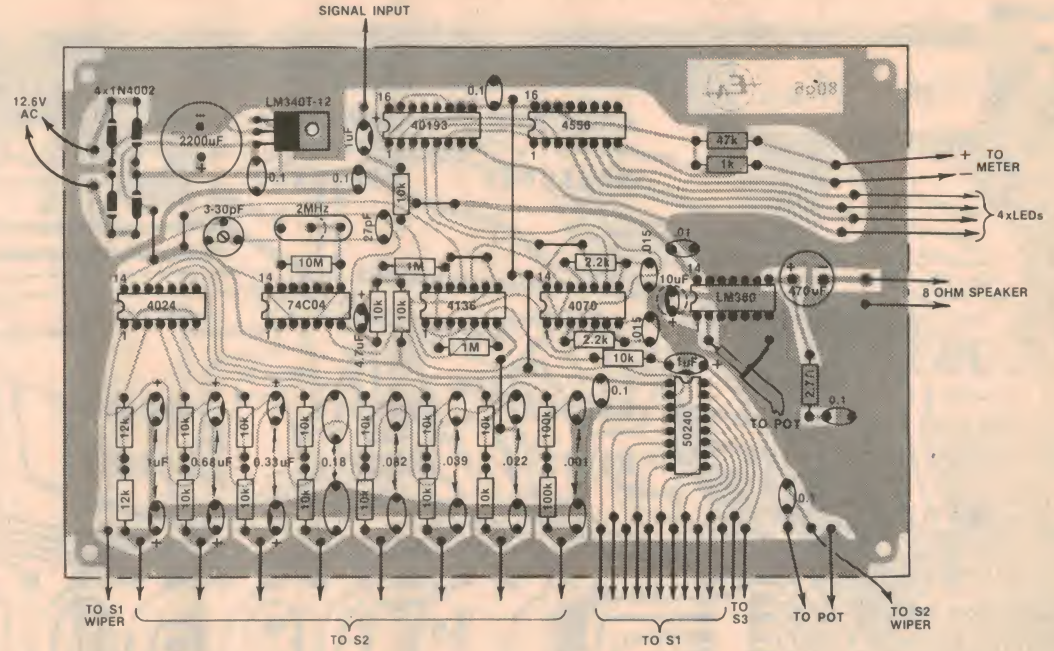


Use ribbon cable to the switches to keep the wiring tidy.

PARTS LIST

- *1 Horwood instruments case, 204 x 100 x 210mm (W x H x D)*
- *1 Front panel overlay, 204 x 90mm*
- *4 rubber feet*
- *2 single-pole, 12-position rotary switches (see text)*
- *1 SPDT miniature toggle switch*
- *1 edge-reading meter scaled 0-10*
- *3 knobs*
- *1 miniature 8 ohm loudspeaker*
- *2 metres of 3-core mains cord and 3-pin plug*
- *1 mains cord clamp and grommet*
- *1 three-way insulated terminal block*
- *1 6.5mm jack socket*
- *3 RCA sockets, single-hole mounting*
- *1 PCB, 177 x 110mm, code 80g6*
- *1 transformer, 12.6V secondary, Ferguson 2851, A&R 6474, DSE 2851 or equivalent*
- *1 2MHz crystal, 20pF ambient HC-33/U (see text)*
- *4 PCB spacers*

SEMICONDUCTORS

- *4 1N4002 rectifier diodes*
- *4 red LEDs with bezels*
- *1 LM340T-12, uA7812 12V 3-terminal regulator*
- *1 50240 top-octave synthesizer*
- *1 4069, 74C04 unbuffered hex inverter*
- *1 4030, 4070 quad exclusive-OR gate*
- *1 40193, 74C193 up-down binary counter*
- *1 4556 dual 2-to-4-line decoder*
- *1 4024 7-stage ripple counter*
- *1 uA4136 quad op amp*
- *1 LM380 14-pin power amplifier*

CAPACITORS

- *1 2200uF or 2500uF/25VW PC electrolytic*
- *1 470uF/16VW PC electrolytic*
- *1 10uF/16VW PC electrolytic*
- *1 4.7uF/16VW tantalum electrolytic*
- *4 1uF/35VW tantalum electrolytic*
- *2 0.68uF/35VW tantalum electrolytic*
- *2 0.33uF/35VW tantalum electrolytic*
- *2 0.18uF/100VW metallised polyester (greencap)*
- *6 0.1uF greencap*
- *2 .082uF greencap*
- *2 .039uF greencap*
- *2 .022uF greencap*
- *2 .015uF greencap*
- *1 .01uF greencap*
- *2 .001uF greencap or polystyrene*
- *1 27pF polystyrene or NPO ceramic*
- *1 3-30PF Cermet or Philips trimmer*

RESISTORS

(5% tolerance, ¼ or ½W rating)

1 x 10M, 2 x 1M, 2 x 100k, 1 x 47k, 16 x 10k, 2 x 12k, 2 x 2.2k, 1 x 1k, 1 x 2.7 ohms

1 470k (log) potentiometer with switch

MISCELLANEOUS

Solder, solder lug, hookup wire (various colours), screws, nuts.

NOTE: Ratings are those used on the prototype. Components with higher ratings may generally be used providing they are physically compatible. Components with lower ratings may also be used in some cases provided the ratings are not exceeded.

decoder. This has four mutually exclusive outputs which drive the four LEDs. Even though the outputs are mutually exclusive, there is still a fluctuation in the LED current through the common 1k resistor. This fluctuation is monitored by the meter to give a better indication of very low frequency beats.

Power supply requirements are quite modest. All the CMOS circuitry runs from +12V provided by a three-terminal regulator, LM340T-12 or uA7812. The LM380 amplifier IC runs directly from the unregulated DC of approximately 18 volts provided by the bridge rectifier, 2200uF/25VW capacitor and 12.6V transformer.

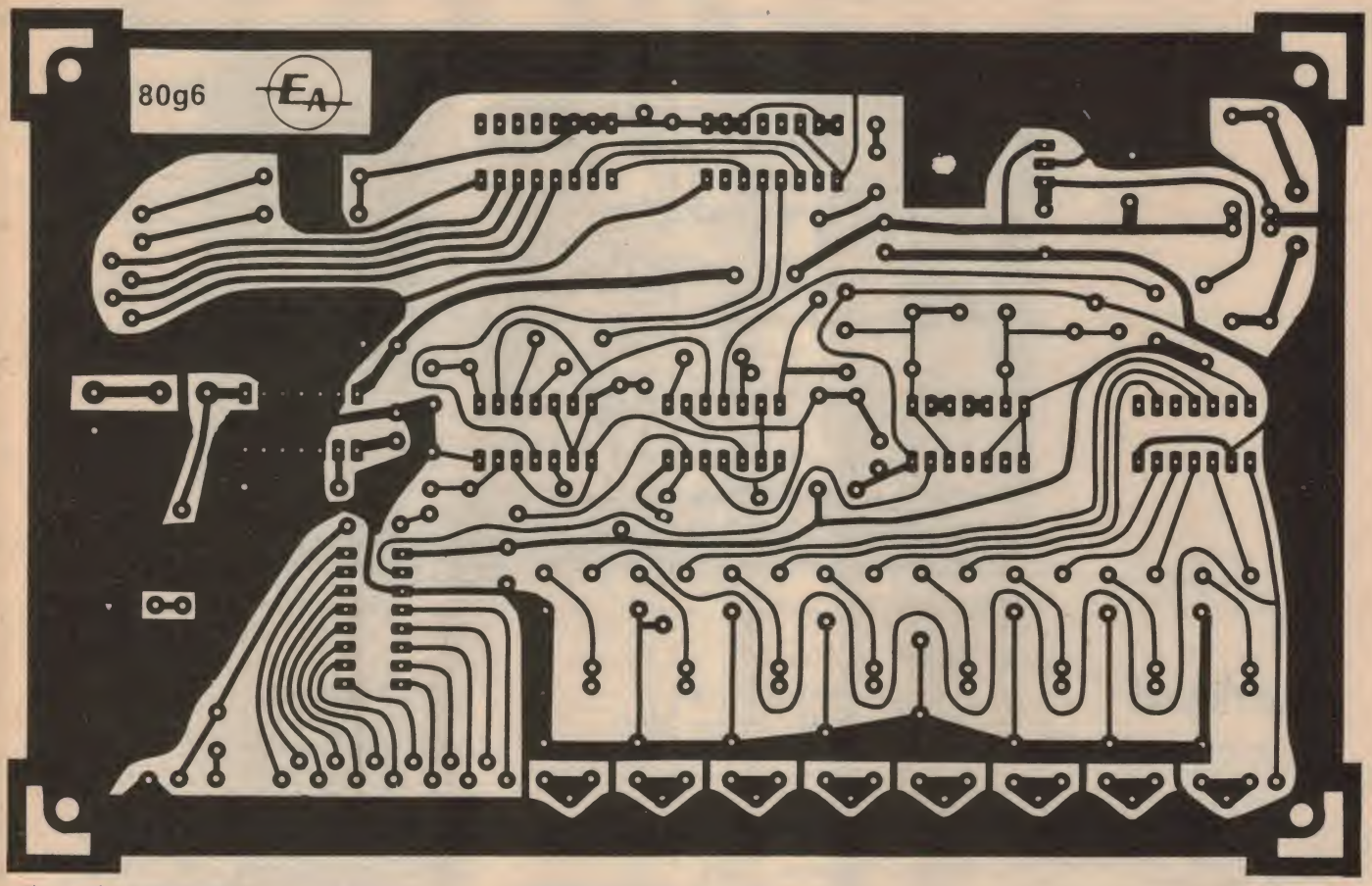
CONSTRUCTION

All the circuitry, with the exception of the switches and other hardware is mounted on a PCB measuring 177 x 110mm and coded 80g6.

The printed circuit board should be available from the usual outlets by the time this appears in print. The box which houses the instrument is made by Horwood and should be available from most stores.

The Scotchcal label for the front panel is obtainable also from Radio Despatch Services, as is the Horwood box.

The meter is also a common type and no trouble should be experienced here. The LEDs which we used on the prototype have chrome plated bezels and are rather expensive. However, other types may be used.



This is the full size PCB artwork.

Construction should begin with the assembly of the PCB. In carrying out this task, the usual precautions should be taken. A good soldering iron with a bit suited to small work is a must and care should be taken not to overheat components during soldering. Also, care should be taken to be sure that every soldered joint is a good one and that the solder has flowed properly. Resin cored solder ONLY should be used. It has come to our notice recently that some builders in their keenness to do a "good" job have used corrosive fluxes. This practice should be strictly avoided.

The use of sockets is optional. We used a socket for the most expensive chip but soldered the rest directly into circuit. If you elect to solder the ICs directly to the board, the barrel of the soldering iron should be connected with a clip lead to the "earthy" copper of the board. In any case, MOS ICs should only be removed from their packing immediately prior to fitting them to the board.

It is generally convenient to start the board assembly by fixing the smallest components first. There are seven jumpers on the board and they should be fitted first, using some 22 gauge tinned copper wire. These may be followed by the resistors, small capacitors, diodes, ICs or sockets, checking carefully for dry joints. Care should be taken to observe the polarity of components where this applies. At this stage, the PCB may be put aside until later on.

We estimate that the current cost of parts for this project is approximately

$85

This includes sales tax.

Fitting the Scotchcal overlay to the front panel is a tricky job and calls for some care. This done, all the holes should be drilled, taking care not to damage the panel. All components may then be fitted to the panel. Provided a very neat fitting hole is cut for the meter, it may be made a push fit, without any other fixing. Alternatively, some judicious use of a suitable adhesive could suffice.

There is no direct means of fitting the miniature loudspeakers to the panel. We solved the problem by fixing it with four spots of Araldite epoxy adhesive, allowing it to set overnight.

Two one-pole, 12-position rotary switches will be required. If C&K Lorlin switches are purchased, one may be modified to operate as an eight-position switch for the octave selector. Otherwise, just ignore the unused four positions. The two switches should be oriented so that their knobs point to the correct markings on the panel. The stop for the note selector is between B and C.

The back panel of the box requires five holes, three for the RCA sockets, one for the external speaker jack and one for the mains lead rubber grommet. The bottom of the box requires four holes for mounting the PCB, four for fixing the mains lead terminal strip and transformer, and one for the mains lead clamp. The PCB should be located so that there is about equal space between the board edges and the front and back panels.

Before fitting the PCB to the box, there are some preparatory matters to be dealt with. The sockets and rubber grommet are now fixed to the back panel. The mains cord may also be fitted and terminated and clamped. The green or earth lead should be terminated on a

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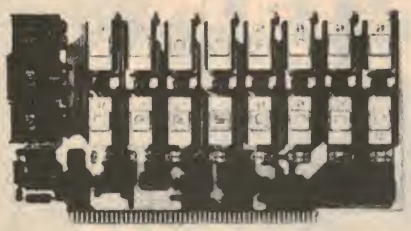

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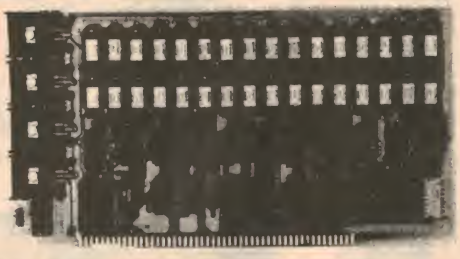
A&T $269



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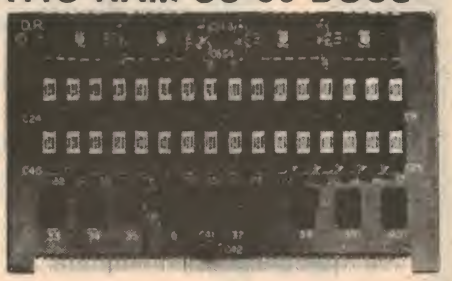

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solder lug held with one of the back panel fixing screws.

Before the PCB is fitted, all leads destined for external points must be added. Those leads to the two rotary switches should best be made with rainbow cable to help with identification. In the prototype, we used shielded audio leads from the input to the LM380 and from the volume control to the RCA socket on the back panel.

With the PCB fully prepared, mount it in the box, using four tapped spacers and suitable screws. Do not attempt to wire the rotary switches at this stage. Rather, push the relevant cables out of the way so that the rest of the wiring may be done. Wire the volume control first, terminating the shield leads on the appropriate lug. This lug is also connected back to the board via an earth lead. The other ends of the shielded leads have the shields cut off. The switch on the volume control may now be wired.

When you are satisfied that all the wiring is complete it should be thoroughly checked to make sure that there are no errors. This check should include the PCB as well. Components should be checked for correct placement and value, as well as correct polarity. Satisfied that all is well, it is ready to be given its initial tests.

If you have a frequency counter and you intend to set the crystal to the frequency of your choice, then now would be a good time to do it. The crystal signal may be taken off between a ground point and pin 6 of the 74C04. Switch on and if all is well the crystal frequency should appear on the counter. Set to the wanted frequency with the trimmer capacitor.

AUDIBLE CHECKS

It should now be possible to make some audible checks. A good place to start would be with A440. Set the two switches to this position and advance the volume control. The 440Hz tone should be heard from the speaker. Now rotate the upper switch right across the scale from C to B and all notes should be heard and in their right order. If the order is not right, there is a switching problem to be corrected. Now rotate the octave selector and the various octaves of the note selected should be heard, again in their respective order. The toggle switch selects C9, top C available.

Due to the inability of the small speaker to reproduce the lower frequencies, it may not be possible to hear anything in the lower couple of octaves or so. This may be remedied by plugging in a larger enclosed speaker into the jack provided.

During these tests, the four LEDs should appear to be on and the meter should read about half scale. With C selected on the upper switch, C8 on the toggle switch and the lowest octave on the lower switch, the LEDs will appear to be flickering. Actually, the LEDs are not all on at the one time but they are rotating, at a low speed for the low frequencies, increasing as the frequency is increased.

If you have observed all the above, it is a good bet that your Musical Tone Generator is working properly and ready for service.

HOW TO USE IT

The method of using the generator for tuning a musical instrument will depend largely on the type of instrument being tuned. If it is an acoustic instrument such as a piano, then the sound from the speaker will be used to bring the corresponding tone of the instrument to zero beat. An external speaker will of course be necessary for a job such as this one. The LEDs and the meter will be ignored for this type of operation. Another method of tuning an acoustic instrument would involve the use of a microphone so that the LED beat indicator could be employed. This would require a suitable microphone preamplifier.

If you wish to tune an electronic organ, the output from an appropriate speaker on the organ will be patched to the input of the generator. A stop will be chosen which is not too loaded with harmonics, such as a flute or tibia and the volume set at a low level so as not to be annoying in its own right. The input preamplifier of the generator will perform satisfactorily with levels ranging from about 50mV to 10V rms.

The note to be adjusted is selected on the keyboard and the corresponding note and octave is also selected on the generator. The LEDs will appear to be rotating if the organ note is off tune, the rotation direction will depend on whether the note is higher or lower than the generator. The note is adjusted so that the LED rotation stops and then the needle of the meter may still be moving slowly and adjustment is then made until the needle remains stationary.

Rack mounting 300 Watt Amplifier

has load-line & loudspeaker protection

Our new Playmaster 300W Amplifer has already created a great deal of interest. This month, we tell you how to fit the completed amplifier module into a 483mm (19-inch) rack mounting case together with a power supply, fan cooling and loudspeaker protection circuitry.

by JOHN CLARKE and GREG SWAIN

Last month, we published full constructional details for a rugged, high-power amplifier module capable of delivering 300W RMS into a 4 ohm load. By following this article, readers should have little difficulty putting the module to work in a practical amplifier suitable for stage work or wherever high-power amplification is required.

We also have no doubt that some readers will be power-hungry enough to build a stereo version of this amplifier for use in a home hifi system. Matched with suitable loudspeakers, the noise that such a system could produce would be devasting!

Constructors should note that a 10 ohm/1W resistor should be used in place of one of the wire links if two modules are to be used in a stereo system. This measure is to avoid possible hum problems due to earth loops and was shown on the component overlay diagram on page 59 of the June issue.

SPEAKER PROTECTOR

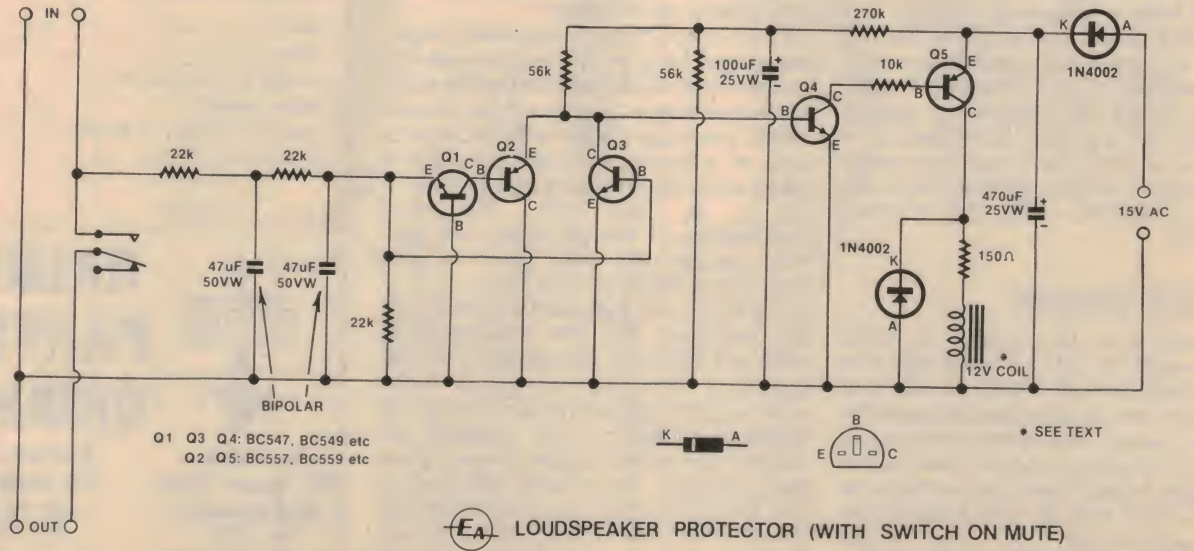
Apart from the power supply, the only extra circuitry required for the complete amplifier is the loudspeaker protection circuit. This feature is mandatory for any amplifier of this power. Without protection, the loudspeaker could be driven by the full supply rails in the event of a fault and be destroyed.

The circuit published here is a slight modification of the Loudspeaker Protector published in November, 1975 (File No. 1/MS/13). Basically, it consists of a relay which normally connects the loudspeaker to the amplifier a few seconds after switch-on, thus eliminating switch-on transients. If a fault subsequently occurs within the amplifier such that the DC offset voltage rises above ±2V, the relay trips and disconnects the loudspeaker from the amplifier.

Five general purpose transistors are employed in the circuit. Q5 drives the relay direct and is controlled by Q4 via the 10k resistor. When Q4 conducts, so does Q5. A diode in the collector circuit of Q5 protects the transistor against inductive kick-back from the relay when it is de-energised.

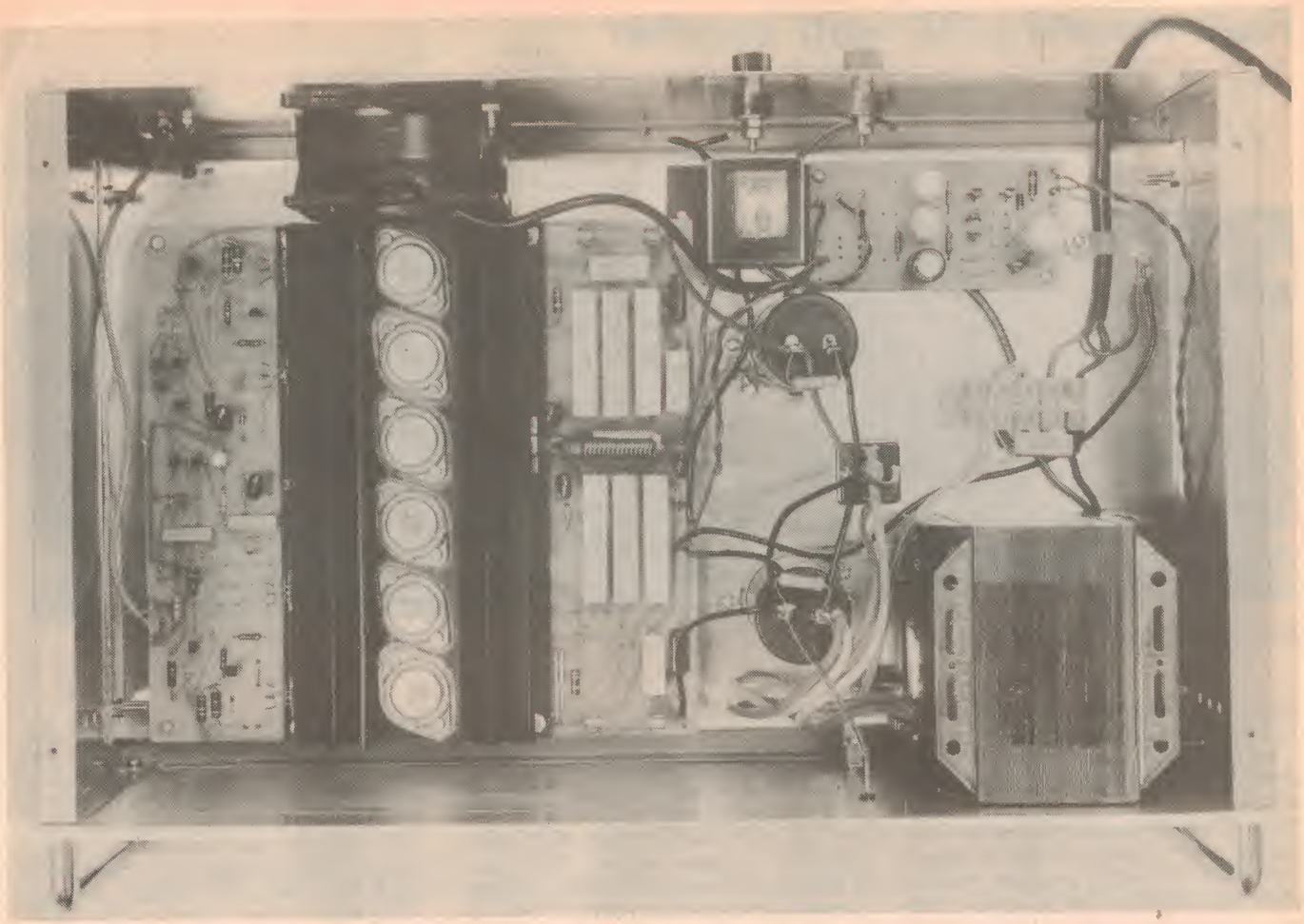
Base bias for Q4 is provided by a network consisting of two 56k resistors, one 270k resistor and a 100uF capacitor. At initial switch-on of the amplifier the 100uF capacitor has zero charge, so no forward bias is applied to Q4 and the relay is off. After about three seconds, the capacitor is charged sufficiently to cause Q4 and then Q5 to conduct and energise the relay. This connects the loudspeaker to the amplifier after the required delay.

Q1, Q2 and Q3 form an odd-looking triple which monitors the amplifier output for DC fault conditions. They function as follows:



LOUDSPEAKER PROTECTOR (WITH SWITCH ON MUTE)

Five transistors, a relay and a few other components make up the loudspeaker protector circuit.



Note how the cooling fan is positioned directly behind the heatsink. Be sure to keep all mains wiring neat and tidy.

The output of the amplifier is monitored via a low pass filter consisting of three 22k resistors and two non-polarised 47uF capacitors. If the amplifier output goes positive by more than 2V, Q3 is forward biased and it conducts to remove the base bias from Q4. Hence Q4 and Q5 turn off and the relay disconnects the loudspeaker.

Similarly, if the amplifier output becomes negative by more than 2V, the emitter of Q1 is made negative with respect to its base. Q1 is thus forced to conduct as is Q2, thus removing the bias from Q4 and turning off Q4 and Q5 as before.

So all the transistors function as simple switches which are only controlled by the presence of DC voltages at the amplifier outputs. AC signals have negligible effect due to the input low-pass filter.

Power for the loudspeaker protector is derived from a 15V winding on the transformer, giving a supply rail of about 20V DC after half-wave rectification and filtering. A 150 ohm/1W resistor is used in series with the relay to limit the voltage across it to 12V.

There are two different relays that can be used with the loudspeaker protector. We used a "power relay" with double changeover 10A contacts from Dick Smith Electronics. This relay is physically larger than the 5A relay used in the original circuit, and must be mounted off the board as shown in the wiring diagram. Note that only one set of changeover contacts is used.

Alternatively, a much smaller relay distributed by Associated Controls (55 Fairford Rd, Padstow 2211) can be used. Designated VS 12TAN, this is a single-pole relay with 10A contacts that, unlike the Dick Smith relay, can be mounted directly on the PC board. It will be necessary to bend the pins slightly to make the relay fit.

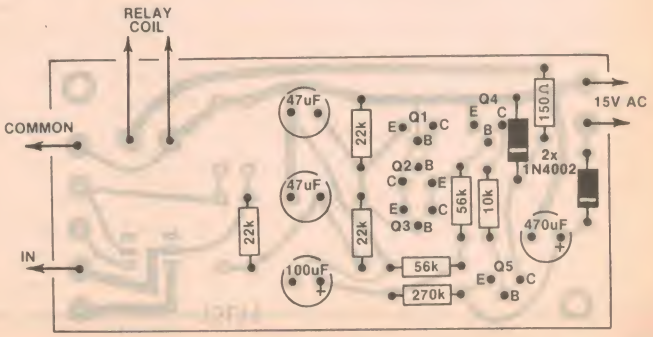
We expect that the VS 12TAN relay will be available through components suppliers by the time this article appears.

Assembly of the loudspeaker protector PC board is straightforward. Just follow the accompanying overlay diagram closely, making sure that the transistors and diodes are correctly oriented. The non-polarised capacitors can be soldered in either way, with no regard for polarity.

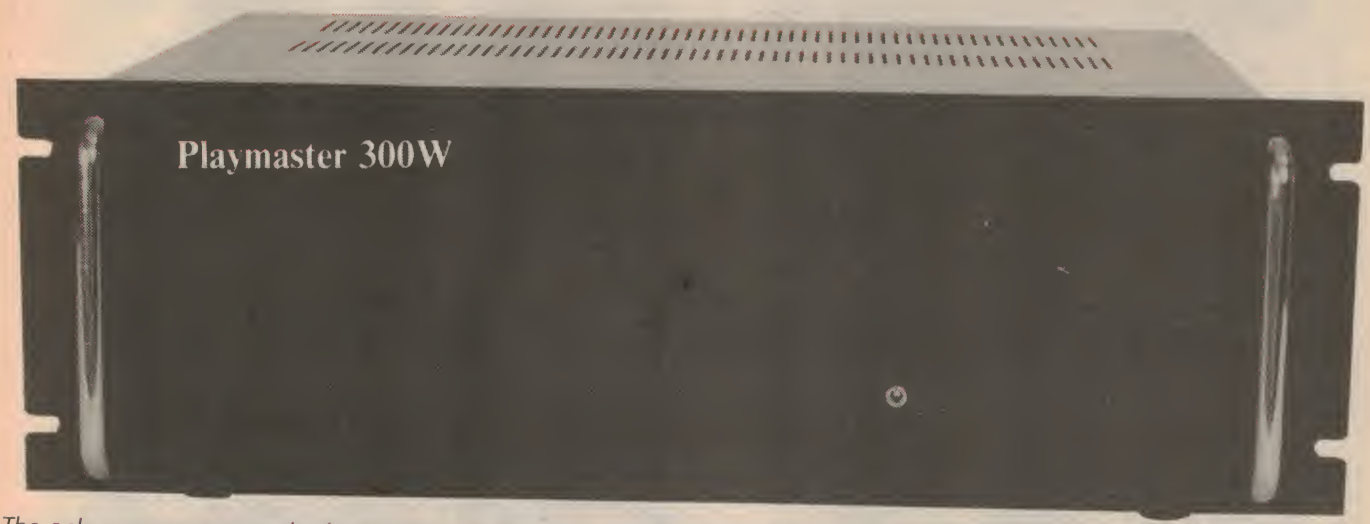
The use of PC stakes is recommended to facilitate external connections to the PC board.

FAN COOLING

As mentioned in last month's article, the heatsink on the amplifier module is quite adequate for typical program material peaking at full power. However, for those who intend to use the amplifier for stage work, we have made provision for fan cooling. The fan is mounted on



RIGHT: The PC board layout for the loudspeaker protector. Additional connections will have to be made to the board if the VS 12TAN relay is used.



The only components on the front panel are the on/off switch and the LED indicator. At right is the wiring diagram.

the rear panel of the chassis and blows cool air across the heatsink.

Our prototype used a Mulfingen Type 7119 fan which has a nominal diameter of 80mm and is designed to run from 220V AC. A 680 ohm/5W resistor is included in series with the fan to ensure that it does not suffer premature failure when connected to the Australian 240V mains. With this resistor, the voltage across the fan will be slightly less than 220V AC. This fan is available from Stewart Electronics, 33 Sunhill Road, Mt Waverley, Victoria.

Other fan types should also be suitable and include the "Sprite" sold by Radio Despatch Service (869 George St, Sydney), and the Yaesu D-2865 as sold by Dick Smith Electronics. Like the Mulfingen fan, the Sprite is some 80mm in diameter but has the advantage that it can be run directly from the mains without a dropping resistor. The Yaesu D-2865 is somewhat smaller at 70mm diameter. It is rated at 120V AC and can be run directly from the 94V AC (47V + 47V) transformer secondary. Paris Radio, of 7a Burton St, Darlinghurst, NSW, also have suitable fans.

The power supply circuitry was featured last month and has been kept as simple as possible. A centre-tapped bridge rectifier circuit produces the positive and negative 70V rails for the power amplifier. These are bypassed with large value (4000uF) electrolytic capacitors to ensure low supply ripple.

As can be seen from the wiring diagram, the 0V output from the power supply is connected to chassis earth, providing the reference level for the supply rails. The input earth for the amplifier is decoupled from the chassis earth via a .01uF capacitor connected from the input lead shield to chassis.

Before proceeding further, we will repeat the warning given last month concerning the power supply voltages. In addition to the normal hazard from the mains, the power supply produces a total of 140V DC. This voltage is present on the PC board and is **dangerous.** Do the wrong thing and it could prove **fatal!**

CONSTRUCTION

Start the mechanical construction by temporarily bolting the case together. The case we used (from Dick Smith Electronics) measured 425 x 140 x 250mm (W x H x D inside box) and featured generous ventilation slots on the top and bottom panels. These ventilation slots

PARTS LIST

LOUDSPEAKER PROTECTOR

1 PC board code 75L11, 102 x 51mm
3 BC547 NPN transistors
2 BC557 PNP transistors
2 1N4002 silicon diodes
1 470uF/25VW PC electrolytic
1 100uF/25VW PC electrolytic
2 47uF/50VW non-polarised electrolytics
1 12V DC relay, 10A contacts (see text)
6 PC stakes
RESISTORS (¼ or ½W, 5%)
1 x 270k, 2 x 56k, 3 x 22k, 1 x 10k, 1 x 150 ohm/1W

CHASSIS & HARDWARE

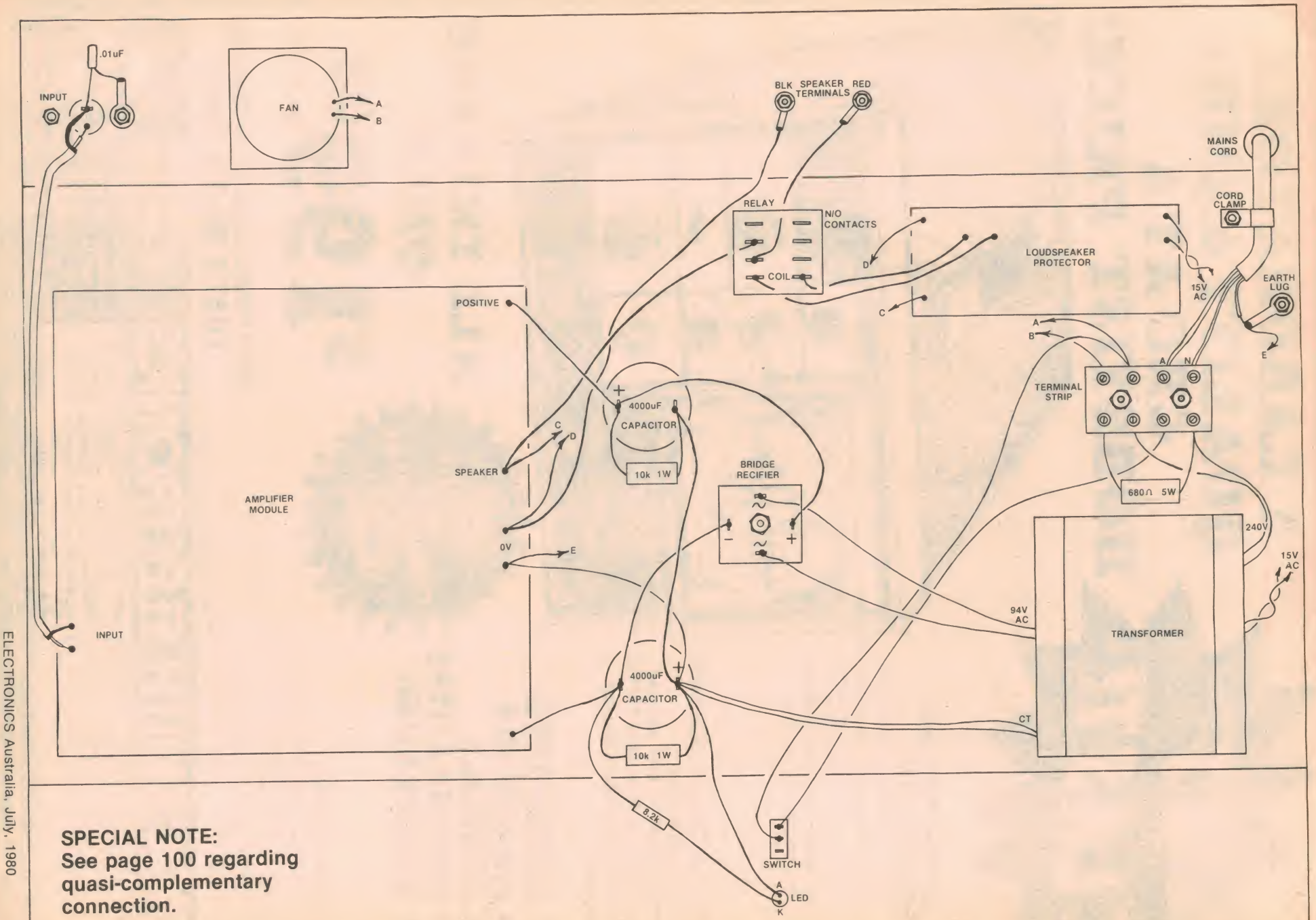
1 power amplifier module (see last month)
1 power supply (see last month)
1 483mm rack mounting case, 425 x 140 x 250mm (W x H x D)
1 80mm cooling fan (optional), see text
1 Scotchcal front panel label
1 SPDT 240V AC miniature toggle switch
1 5mm red LED and mounting bezel
2 14mm speaker terminal binding posts
1 RCA panel mounting socket
6 6mm brass spacers
1 22cm length shielded cable
1 8.2k resistor (¼ or ½W, 5%)
1 680 ohm/5W resistor (see text)
1 .01uF polyester capacitor
1 mains cord clamp
1 four-way insulated terminal block

MISCELLANEOUS
Hook-up wire, 24 x 0.2mm core heavy duty hook-up wire, machine screws and nuts, solder, insulation tape etc.
NOTE: Ratings are those used for the prototype. Components with higher ratings may be used provided they are physically compatible.

We estimate that the current cost of parts for this project is approximately

$220

This includes the amplifier module, power supply, loudspeaker protector, case and fan.



SPECIAL NOTE:
See page 100 regarding quasi-complementary connection.

AT LAST!

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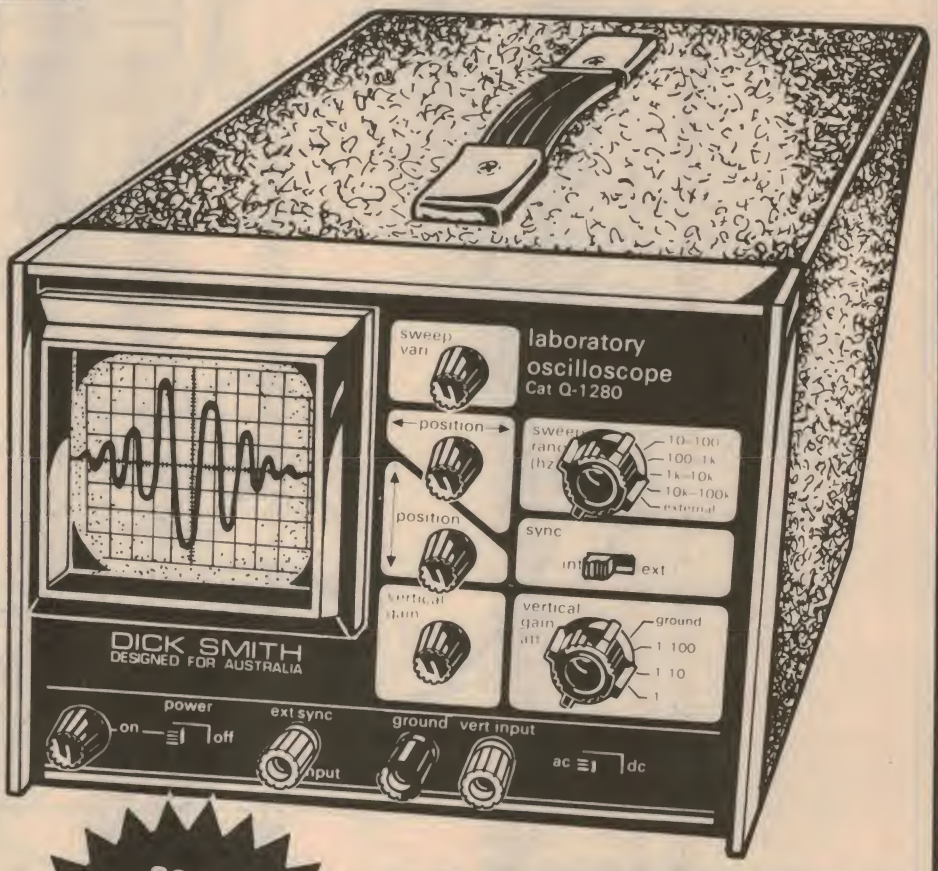

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DSE772

are a must if fan cooling is to be effective.

Once the case is assembled, the two PC boards and the power supply components can be positioned on the base of the chassis and positions for the mounting holes marked. Use the accompanying wiring diagram and the interior photograph to guide your layout. This done, the case can be quickly disassembled to make drilling easier.

The two PC boards can now be mounted in place on the chassis using 6mm brass spacers. In the prototype, the amplifier module was supported at the four corners of the heatsink only, as this was considered to give sufficient mechanical strength. Some constructors may prefer to also use the four extra mounting holes at the corners of the module for additional support, particularly if the amplifier is to be used for stage work.

Make sure that the amplifier module is mounted well forward to provide sufficient clearance for the cooling fan.

The power transformer should be oriented with its 47V + 47V secondary leads facing the PC board. It is bolted to the base of the chassis, with one side butted directly against the front panel. Mounted in this fashion, the transformer can also be bolted to the front panel if additional chassis strength is required.

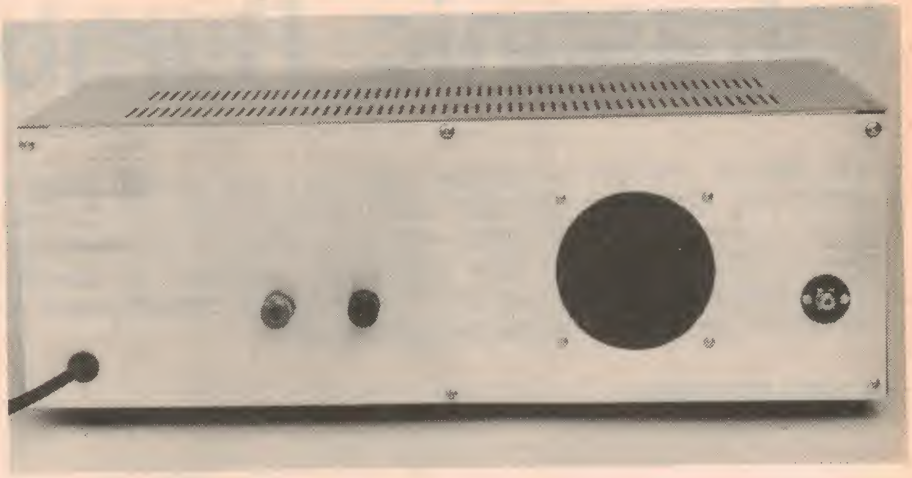
The two 4000uF filter capacitors are mounted in an upright position with clamp brackets, while the bridge rectifier is bolted to the chassis between them. Before mounting the rectifier, smear its underside with heatsink compound to improve heat transfer. There is no need to electrically isolate the rectifier from the chassis.

Note that the relay used in our prototype is mounted on a socket and raised bracket. If difficulty is experienced in obtaining a socket, then the relay can be glued upside down to the chassis base so that its pins are upright. The leads can then be soldered direct to the relay pins.

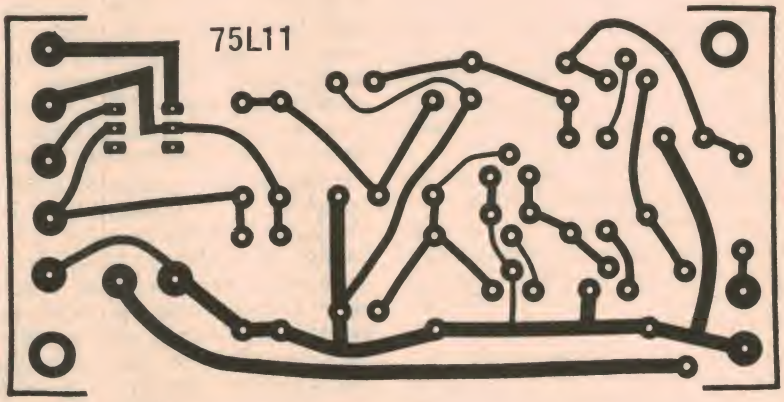
Once work on the chassis base has been completed, the case can be reassembled and the hole positions for the front and rear panel components marked and drilled. These components include the mains switch and the LED indicator on the front panel, and the cooling fan, RCA input socket and loudspeaker terminals on the rear panel.

A large hole will also have to be cut in the rear panel to allow direct air entry to the cooling fan. The fan should be positioned directly behind the heatsink, and must be oriented so that it blows air **into** the chassis.

With all components now mounted in position, the chassis wiring can be completed according to the wiring diagram.



Rear view of the completed amplifier chassis. The large hole at right allows direct air entry to the cooling fan.



Above: Full size artwork for the loudspeaker protector PC board.

The mains cord should be passed through a grommeted hole in the rear of the chassis and anchored with a cord clamp. Terminate the mains active and neutral to the terminal block and solder the earth wire to a solder lug adjacent to the cord clamp. Additional wires are run from the terminal block to the mains switch and to the cooling fan.

Use heavy duty (24 x 0.2mm core) hook-up wire for the power supply wiring and check that the voltages delivered by the supply are correct before making the connections to the amplifier module. It is a good idea to wrap the terminals of the mains switch in plastic insulation tape to avoid the possibility of an electric shock.

Note that a short length of shielded cable (about 22cm) is required to connect the amplifier input to the RCA input socket.

The loudspeaker protector should be checked for correct operation before connecting it to the amplifier output. Switch on and check that the relay closes after about two seconds. Drop-out time for the relay after switch-off is less than a second. The relay will close in less than two seconds if the Protector is switched on immediately after it is switched off.

Fault conditions at the input can now be simulated with the aid of a (suitably insulated) jumper lead. Simply connect the active side of the loudspeaker input to the positive +70V rail and then to the −70V rail. In both cases, the relay should open almost immediately and then close again after the simulated fault has been removed.

Satisfied that all is well, the loudspeaker protector can be connected into circuit such that the active loudspeaker line is switched by the relay.

The final job of assembly is to carry out the setting up procedure for the amplifier as described in the June issue. Screw the lid to the case and you will have a rugged, reliable, high-power amplifier costing much less than an equivalent commercial model. But do think of the neighbours, and remember the noise-pollution laws for your state.

Happy listening!

Clean up the bass in your system with an . . .

Infrasonic Rumble Filter

Even though modern turntables have very low rumble output; rumble can still be a problem when listening to records; particularly with amplifiers having response down to DC. This low cost infrasonic rumble filter effectively removes all rumble noises below 20Hz and can give a substantial improvement to record reproduction in some circumstances.

by RON DE JONG

There are two types of rumble: that which you can hear and that which you can't. The latter is infrasonic rumble; involving frequencies below 20Hz. Rumble which you can hear, broadly involving the audio spectrum between 20Hz and 250Hz, is difficult to remove from any hifi system. You can minimise rumble in your system by employing a good quality turntable and by not unduly boosting the bass response.

But if there is rumble present on the record, then you are stuck with it.

Infrasonic rumble is quite another matter. While you may not be able to hear it directly because it lies below 20Hz, it can certainly be the cause of problems in your system. You can quickly gain an idea of whether infrasonic rumble is a problem in your system by removing the grilles from your loudspeakers and then playing a record.

It is possible that you will see the speaker cones wobbling at a low rate. If the record has any ripples in it or you are using bass boost, you may find that the cones wobble quite alarmingly, particularly if you have bass reflex enclosures. Now while you may not regard this as a problem, these very low frequency signals can be the cause of considerable intermodulation of the audible bass region. This intermodulation may take place in the amplifier as well as in the speakers themselves.

Problems with infrasonic rumble can be worse in DC coupled amplifiers, ie, those that have flat response right down to DC. And while most DC amplifiers have a low frequency filter, it generally offers only a modest rate of attenuation, typically 6dB/octave with a 3dB corner frequency of 20Hz. This means that the attenuation is likely to be about 8dB or less at 10Hz which is hardly adequate.

What is needed is a steep cut-off filter which means a rate of attenuation of 18dB/octave or more. With a 3dB point at 20Hz, as before, this will provide a really worthwhile attenuation of low frequencies to eliminate intermodulation. Our filter circuit does just that.

The filter is mounted on a small PC board which can be installed in a separate metal box or inside the amplifier or perhaps even another piece of equipment such as a graphic equaliser. Connections to the rumble filter could be made in the tape loop as with most other add on equipment. Alternatively some amplifiers provide pre-amp out and main amplifier in connections and the filter could be connected between these points. This can also be done with systems in which a separate preamplifier and power amplifier are used.

The performance of the filter circuit is shown in an accompanying panel. Notice that the signal-to-noise ratio is quite high and a good match for even the best preamplifiers and power amplifiers.

Frequency response of the rumble filter is shown in an accompanying graph. The rate of attenuation is 18dB/octave below the 3dB corner frequency of 20Hz. This means that the response at 5Hz is 36dB below reference. In short, infrasonic rumble is eliminated.

Just one integrated circuit provides all the active circuitry for the two channels of the rumble filter. A low cost and low noise uA4136 quad operational amplifier does the job, as shown in the circuit diagram which shows both channels.

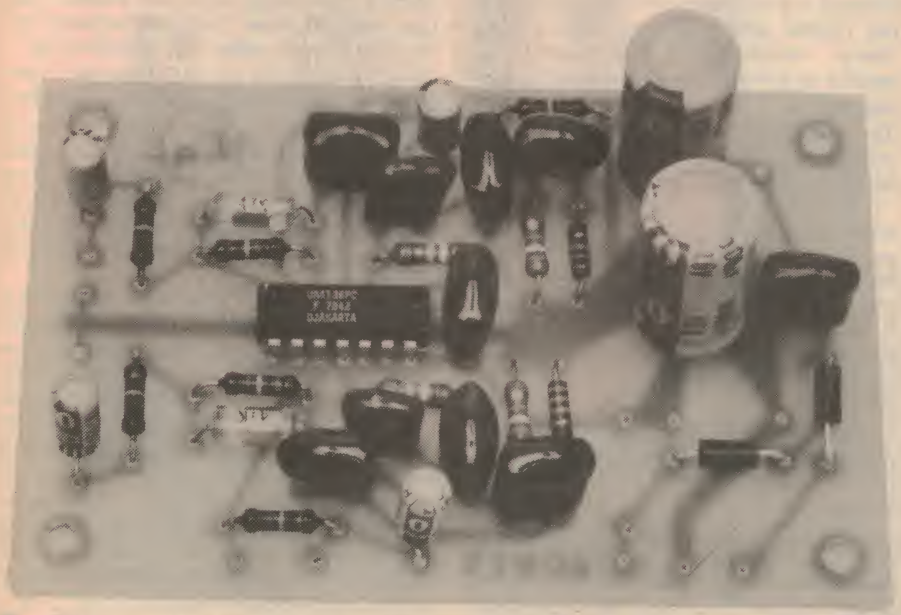
Two op amps are used as unity-gain inverting buffers to provide a low source impedance for the active filters, which are third-order Butterworth. The Butterworth configuration is used here as it has a maximally flat response within the pass-band (ie, above the rolloff point of 20Hz) and minimal phase distortion.

Operation of the filter can be understood by regarding the circuit in the following way. For high frequencies, say above 1kHz, the capacitors can be

We estimate that the current cost of parts for this project is approximately

$10

This includes sales tax.



This PCB should be housed in a small metal box or installed in the amplifier chassis.

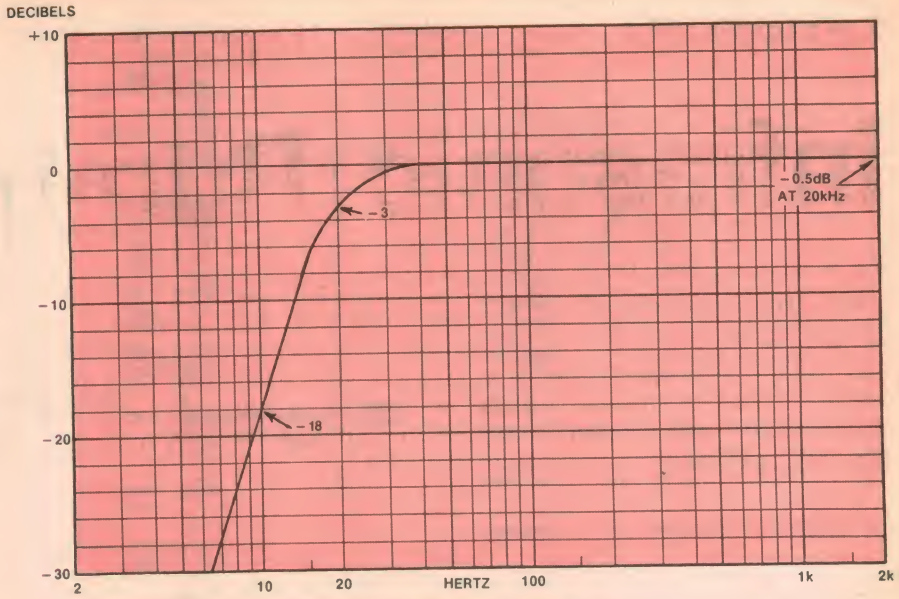
regarded as having low impedance and so the filter circuit works as a unity-gain inverter. At low frequencies the impedance of each of the relevant capacitors (0.1uF, .047uF) becomes appreciable and introduces losses into the signal path.

(A complete derivation of the filter design is given in the National Semiconductor Audio Handbook, in the chapter on "Floobydust".)

Power for the filter unit can be obtained in two ways as shown in the circuit diagram. Either a half-wave rectifier can be used with the power obtained from a 9V transformer winding or a obtained from the split supply of the preamplifier or amplifier. Provision has been made on the board for both configurations.

Typically the power supply of an amplifier will range between ±30 and ±60 volts so we have not specified a particular value for the resistors in the zener regulated supply. The value can be worked out using the formula shown on the circuit diagram, eg if the amplifier power supply was +40V then R = (40-12)/.015 = 1.8k. The resistor should also have an appropriate power rating, in the example above the power dissipated by the resistor is (40-12) × .15 = .42W so a 1W resistor would be used for a reasonable safety margin.

All the circuit components are accommodate on a small PCB measuring 63 x 97mm and coded 80rf5.



FREQUENCY RESPONSE OF RUMBLE FILTER

PERFORMANCE OF PROTOTYPE

Maximum input voltage:	5V RMS
Input impedance:	100k
Output Impedance:	less than 1k
Signal-to-noise ratio:	96db with respect to 1V RMS
Distortion at 1V RMS:	.0025% at 1kHz .012% at 10kHz .02% at 20kHz
Gain:	−0.5dB at 1kHz
Frequency response:	see graph

RUMBLE FILTER

Construction of the unit should present few difficulties. The only points to note are that the orientation of the uA4136 IC electrolytic capacitors and the diodes should be correct according to the wiring diagram, and that shielded audio cable must be used for the connections to the inputs and outputs of the filter.

For best signal-to-noise ratio the filter PCB should be installed in a separate metal box or within the confines of an amplifier, stereo receiver or graphic equaliser chassis and well away from transformer hum fields.

In conclusion, we should note that some readers may wish to raise the corner frequency of this filter to increase the attenuation of lower frequencies and thus bring about a reduction of audible rumble. For example, the corner frequency may be changed to 60Hz by merely scaling the capacitor values, ie, those marked 0.1uF are changed to .033uF and those marked .047uF are changed to .015uF.

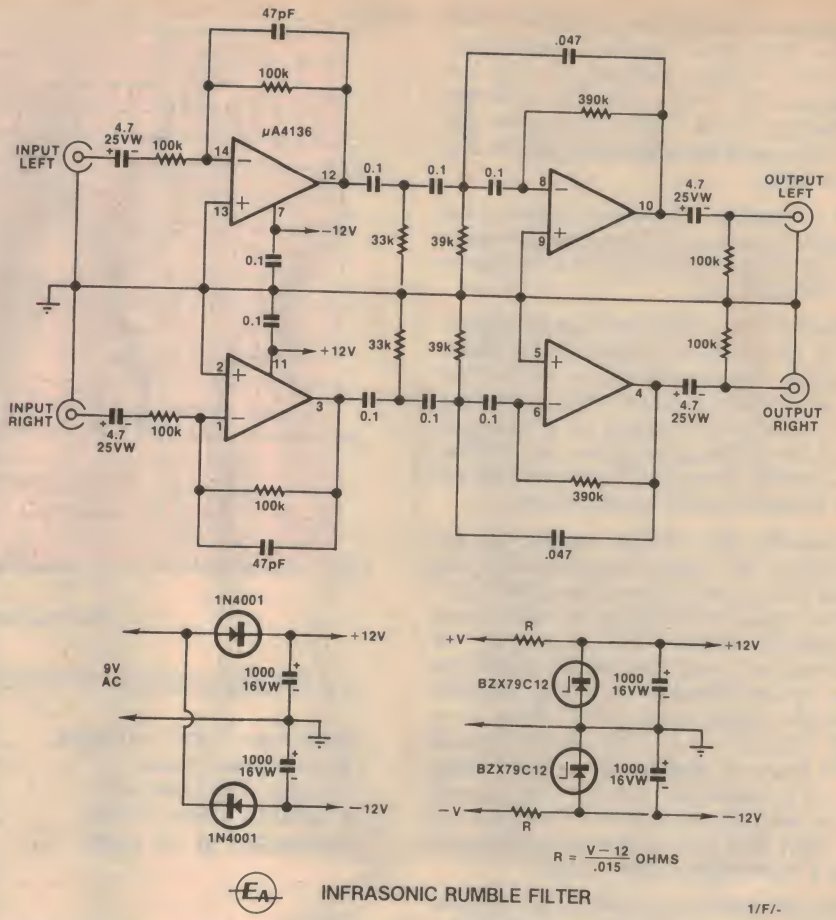
With these changes, the response is −18dB at 30Hz, −30dB at 20Hz, −48dB at 10Hz and −56dB at 5Hz.

PARTS LIST

1 PCB, 63 x 97mm, code 80rf5
1 uA4136 op amp
2 BZX79 C12 zener diodes (see text)
2 1N4001 diodes (see text)

CAPACITORS
2 1000uF 16VW PC electrolytics
4 4.7uF 25VW PC electrolytics
8 0.1uF greencap (metallised polyester)
2 0.047uF greencap
2 47pF polystyrene

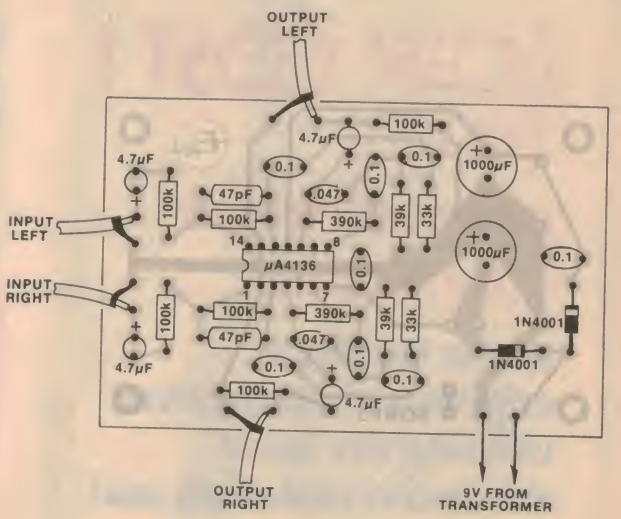
RESISTORS (all ¼ watt 5%):
2 x 390k, 6 x 100k, 2 x 39k, 2 x 33k



EA INFRASONIC RUMBLE FILTER 1/F/-

See the end of this article for modifications to the filter corner frequency.

At left is the actual size artowrk for the PCB.



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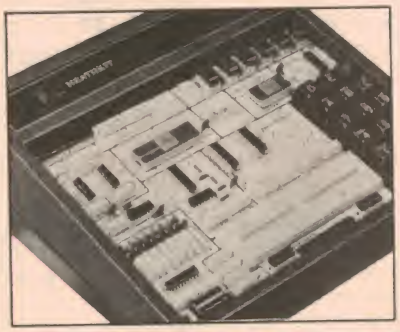

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Program a 2708 in two minutes flat!

EPROM Programmer suits the TRS-80, Sorcerer, &c.

If you have ever wanted to rewrite or extend the operating system of your microcomputer or if you're interested in dedicated microprocessor applications then this EPROM programmer is just the thing. It is an inexpensive unit that uses readily available ICs, interfaces directly to the expansion bus on the back of all the popular 8080/Z80 microcomputers and programs 2708s, 2716s, 2758s and 2732s.

by RON DE JONG

The ready availability of inexpensive EPROMs particularly the 2708 and 2716, now presents a vast number of possibilities for the computer enthusiast. Since EPROMs can be conveniently erased and reprogrammed, the operating system of a microcomputer could be modified or extended to include such features as renumbering routines in BASIC. The Compucolor microcomputer for example provides for 8k of additional ROM while the ROM-PACs used on the Sorcerers have provision for the use of EPROMs rather than ROMs.

Some more exciting possibilities are in the area of dedicated microprocessor applications. Just to mention a few — robots, intelligent video terminals, music synthesisers, train controllers, speech recognisers, and burglar alarms. It is a simple matter to prototype these sort of devices by first running the operating programs on such systems as the 6800 D2 kit, or by using the numerous assembler editor programs available with most computers.

The problem up until now though has been the lack of EPROM programmers suited for use with personal computers. With this in mind, we decided to design an EPROM programmer suitable for direct connection to the bus expansion ports of personal computers, in particular, the 8080 and Z80-based machines such as the Exidy Scorcerer and Tandy TRS-80.

Our EPROM programmer programs the popular 2708 as well as the more recent 2716, 2758 and 2732 EPROMs. It can read the contents of the EPROM to check that it has been erased prior to programming and check that the EPROM does in fact contain the correct data after programming. Using the machine language driver shown elsewhere in this article programming time is about two minutes for a 2708.

Before discussing the operation of the EPROM programmer, in detail, let's look at the operation and programming requirement of the 2708 and 2716.

The popular 2708 EPROM uses floating-gate avalanche mode MOS transistors as the storage cells. Stored charges on the floating gates are used to control the conduction of the MOS transistors, to determine whether they effectively store a "1" or a "0".

The floating gate's charge is produced by inducing a non-damaging avalanche breakdown in the drain-channel junction of the cell. High energy electrons from the avalanche breakdown are then injected into the floating gate, charging it negatively. Since the floating gate is surrounded by an extremely effective insulator, this charge will remain practically indefinitely, and hence the stored pattern will also remain.

To erase a programmed EPROM, the chip is irradiated with ultra-violet light. The resulting photons impart enough energy to the trapped electrons to allow

While the programmer will accept four EPROM types, the software featured in this article is specifically written to program the 2708. Small modifications to the program are required for the other EPROM types.

them to escape from the floating gate, leaving it uncharged.

An erased EPROM has all memory cells effectively containing 1's, so programming consists of inducing avalanche mode breakdowns in the appropriate cells to produce the required zeros. In principle, one programming pulse is required for each memory location. The appropriate address and data information must be applied to the address and data pins of the EPROM.

In practice, due to power dissipation limits, it is necessary to apply a short programming pulse between .1 and 1ms long to each memory location in sequence. Each complete sequence is called a program loop and N such loops are required, such that the total programming time for each location (N × pulse width) is at least 100ms.

Programming pulses are +26V in amplitude and during programming the CS/WE or chip-select pin must be at +12V. In addition three supplies are required to operate the 2708 during both programming and reading, namely +12V, +5 and -5V. In comparison the 2716 EPROM is considerably easier to program and it requires only the standard +5V supply. It is a 2k x 8 EPROM in which each location only has to be programmed once by a single 50ms TTL-level programming pulse with the chip select high and the Vpp supply at +25V.

The 2758 is a 1k version of the 2716 chip but with one half of the memory defective. Rather than throw these devices away, manufacturers have labelled them 2758A or 2758B depending on which half of the die is defective. These chips still have the advantage over 2708s however since they are single supply EPROMs, like the 2716 itself. Programming requirements are also the same except that the software has to "know" which half of the chip to program.

To see how we have satisfied all these requirements, refer now to the block diagram, Fig. 1 and Fig. 2 which shows the waveforms involved. The programmer occupies 4 consecutive address locations in I/O space. Depending on which of those four addresses is accessed by the microprocessor and whether a read or write operation is performed, one of the six outputs of the address decoder will briefly go low.

Two of the address decoder outputs go to the reset and clock inputs of a 12-bit binary counter. The counter outputs are connected to the address inputs of the EPROM, so that by simply accessing the appropriate addresses the counter can be made to reset or increment. Hence any of the 1024 locations in the 2708 EPROM can be accessed by appropriate reset and increment operations. This actually saves a lot of time because the memory locations of the EPROM will always be accessed in sequence during programming or reading.

Another two outputs from the address decoder drive the program-pulse

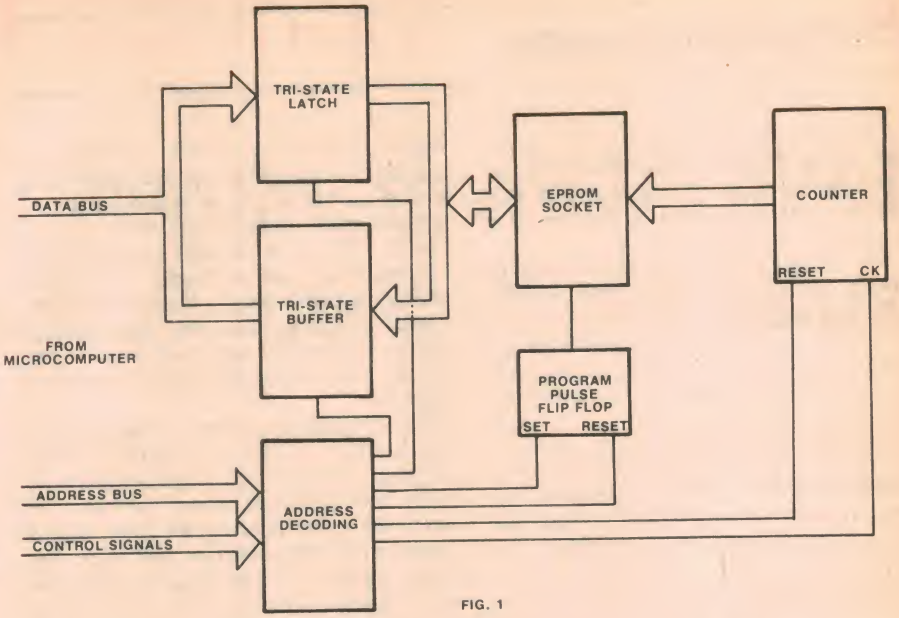


FIG. 1

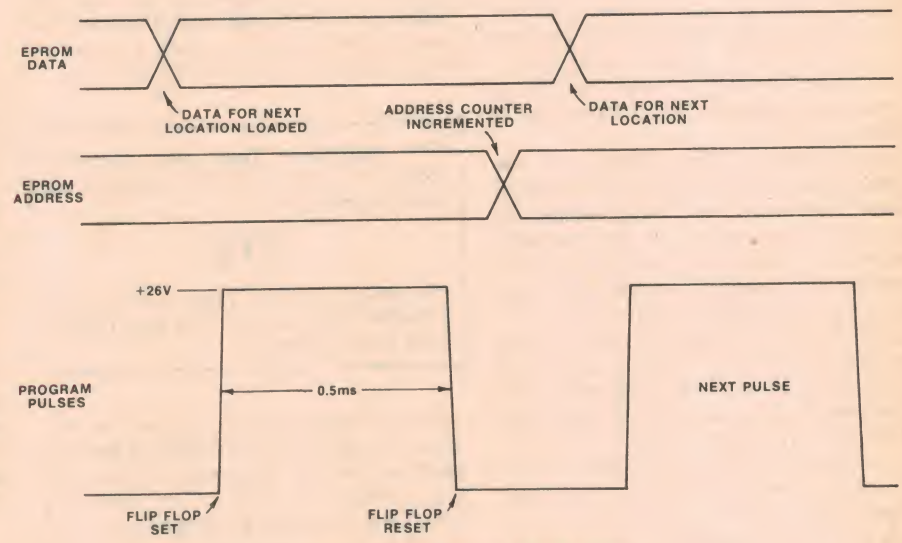


FIG. 2 SEQUENCE OF PROGRAMMING SIGNALS FOR 2708 EPROM

flipflop. One of the lines sets the flipflop and the other resets it. The two remaining lines from the decoder enable the Tristate latch and the Tristate buffer. When the microprocessor reads from a particular address location the Tristate buffer will be enabled and the data present at the output will be read, and when the micro writes to that same location the Tristate latch is enabled instead, latching the data.

Fig. 2 shows how these signals are used to program the 2708 EPROM. Firstly the EPROM programmer must be switched to the program mode so that the Tristate outputs of the EPROM are turned off and the Tristate outputs of latch are turned on. This means that any data written into the Tristate latch by the microprocessor will be present at the data inputs of the EPROM.

Each program loop starts with the address counter being cleared by accessing the appropriate address for each cycle in the loop and then the data for the particular memory location is loaded. A short time later the program-pulse flipflop is set and +26V is then applied to the program pin. After waiting 0.5ms, the microprocessor resets the flipflop which removes the +26V program pulse. The address counter is then incremented and new data loaded for the next location and then the cycle repeats itself.

To satisfy the requirement that the total program time for each location be at least 100ms, 200 program loops are required (200 x 0.5 = 100ms).

Using the software driver shown elsewhere in this article programming time for a 2708 is about two minutes.

In the case of the 2716 or 2758 only one program loop is required but each program pulse is at normal TTL levels and the pulse width for each location is 50ms, giving a total programming time of 100 seconds.

Looking now at the circuit diagram, we can see the various functional blocks in Fig. 1. The data bus, D0 to D7 and the

address bus A0 to A7 can be seen on the left of the diagram. Note that only address lines A0 to A7 are used because the EPROM programmer is connected as an I/0 port.

The control signals provided for on the circuit are IN, OUT, RD, WR, IOREQ, DBUSEN, and BDUSDIR. The first two, IN and OUT, are all that is required for use with the TRS-80. The other controls are required when interfacing to the Exidy Sorcerer.

The purpose of these various signals is as follows: WR will go low during either a memory or I/O write operation by the microprocessor and RD will go low during a memory or I/O read operation. The IOREQ signal goes low when an I/O operation rather than a memory operation is performed. The TANDY TRS-80 combines the RD and IOREQ and WR and IOREQ signals internally to generate the IN and OUT signals respectively. Hence if the TANDY is used, the IOREQ line on the programmer would simply be earthed.

The Sorcerer's signal DBUSEN is the Tristate enable for the data bus provided by the expansion port and it should be low if the data bus is to be enabled. DBUSDIR is the signal to the Sorcerer indicating the direction of the data bus, low for a read and high for write.

The first two address lines A0 and A1 plus the IN and OUT signals go to IC4 which is a dual 2-to-4 line decoder. The remaining six address lines are decoded by IC6 which is a triple 3-input NOR gate. The outputs of IC6a and IC6b will go high only when their inputs are all low. These two outputs are combined by IC7d which then generates a low enable for the rest of the address decoding circuit.

As a result, if all the address lines are connected directly to the inputs of IC6a and IC6b the EPROM programmer will be located at 00 in I/O space. Two inverters, IC5b and IC5c, can be used however to invert any of the six address lines so the EPROM programmer can be relocated quite easily. As it turns out neither the Sorcerer, Compucolor or Tandy machines has anything at 00 location, so you are quite free to locate the programmer there.

Now, the enable signal from IC6c is used to gate the IN and OUT signals via two NAND gates, IC7a and IC7b. These signals then enable either one of the two 2-to-4 decoders. Hence when the correct address is present and an I/O read or write operation is performed, one of the two decoders will be enabled, and depending on the lower two address bits, one of the four outputs of that particular decoder will go low.

To simplify our discussion of the circuit we will assume that the I/O address of the EPROM programmer starts at 0. So when a write to location 0 is performed, output 1Y0 of IC4 will go low, and when a read to location 2, for example, is performed then output 2Y2 will go low briefly. Two of the enable lines go to the Tristate latch and the buffer for reading and programming data. All the other decoded outputs, however, are used as signals themselves and nothing is actually read from or written to the computer's data bus.

The Tristate latch used in the circuit is IC1, a 74LS374. The latch signal is derived from output 1Y0 of the decoder, so when the microprocessor performs an I/O write to location 0 the brief enable signal from the decoder will latch the data present on the data bus into the latch. If the microprocessor performs an I/O read from the same location the 2Y0 output of the decoder would go low instead, enabling the Tristate outputs of IC2 which is an 81LS95 tristate buffer.

We estimate that the current cost of parts for this project is approximately

$75

including sales tax. This includes the cost of the flat cable and connectors.

The remaining outputs of the decoder drive the program-pulse flipflop and the address counter. The program pulse flipflop consists of IC8d, IC8c and IC7c which are 2-output NAND gates and IC5f which is an inverter. IC8d and IC8c are connected together as an RS flipflop, with pin 9 of IC8c as the R input and pin 12 of IC8d as the S input. When a brief low pulse is applied to the S input the output of IC8d will go high and the output of IC8c will go low. Similarly when a low pulse is applied to the R input, the output of IC8d will go low and IC8c will go high.

The SET input of the program pulse flipflop is obtained from output 2Y2 of the decoder so the program is initiated when the microprocessor writes to I/O location 2. The Reset input is obtained from output 2Y1 of the decoder via IC7c and IC5f which together function as a "power-on reset" for the flipflop. This to prevent the flipflop from being set when power is first applied – a situation which could damage the EPROM should the programmer be in the program mode.

Power on reset works as follows. When the power is first applied pin 10 of IC7c will be held low by the 10uF capacitor. The output of IC7c will then be high and the output of IC5f low causing the flipflop to be reset. The capacitor is charged up via a 2.2k resistor so that about 20ms later, pin 10 will be high and the combination of IC7c and IC5f merely pass the signal from the decoder, uninverted to the flipflop and normal operation can follow.

Outputs from the program-pulse flipflop drive a simple class-B output stage which generates the +26V programming pulses. When the flipflop is set the output of IC8d will be high and IC8c low. This causes transistor Q2 to be off and Q1 to be turned on which then turns Q3 on and pulls the output up to the +26V supply line. If the flipflop is reset though, Q1 and Q3 will be off while Q2 will be on.

Rise and fall times for the programming pulses must be within certain limits to ensure reliable programming. This is accomplished by using a .01uF capacitor on the output of the stage along with a 100 ohm resistor in series with the collector of Q3 and a 39 ohm resistor in series with the collector of Q2.

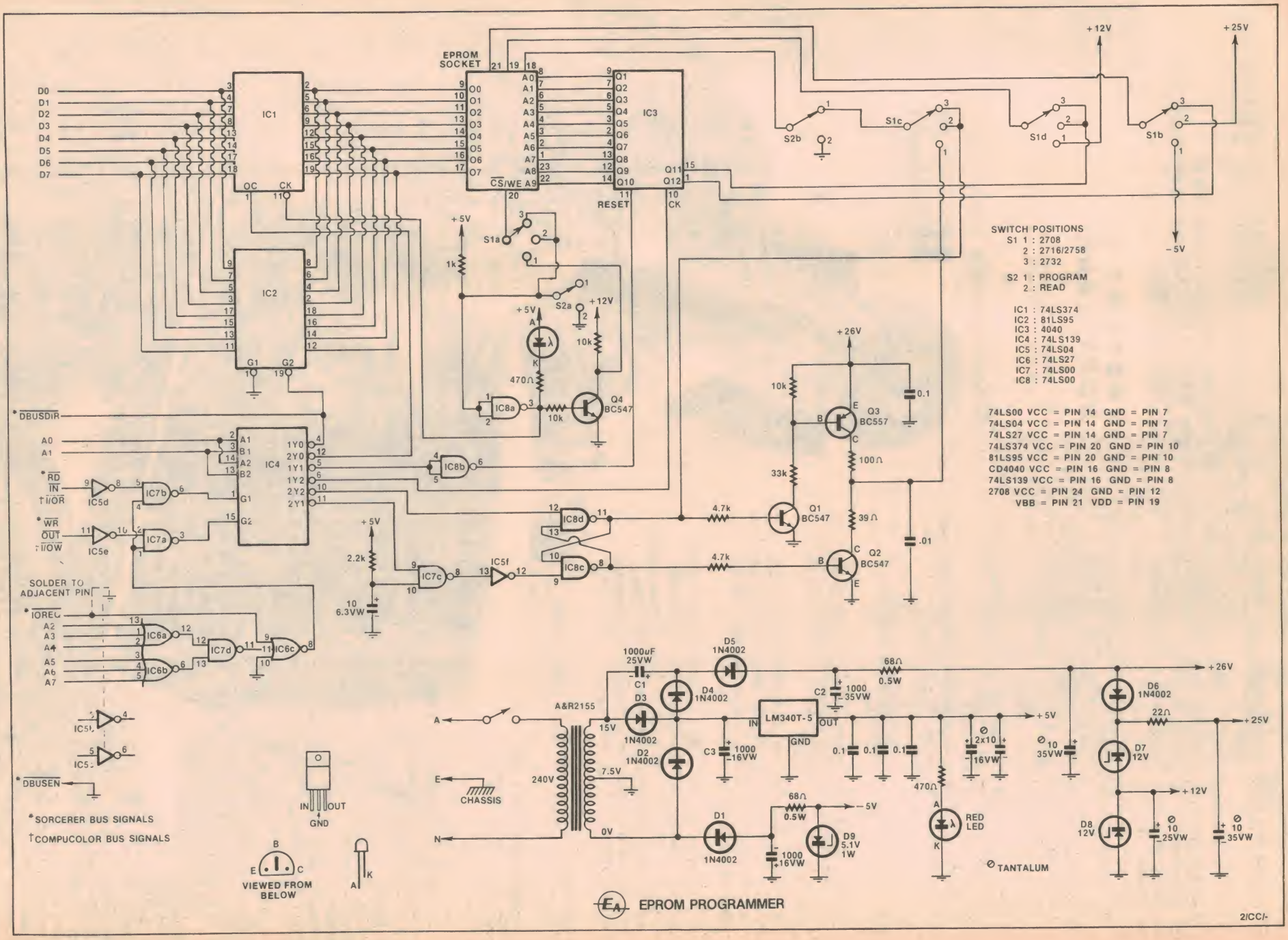
The address counter is IC3 which is a 4040 12-bit CMOS counter. Reset and clock inputs for the counter are obtained from the decoder outputs 1Y1 and 1Y2, respectively. Hence to reset the counter the micro would perform an I/O read from address 1, and to increment the address it would perform an I/O read from location 2. Note that IC8b inverts the signal to the rest input of the counter because the outputs of the decoder are active low while the counter resets on a high.

That completes our description of the basic data, address and programming circuitry. Data and address lines for the various EPROMs are in fact the same except for pins 18, 19, 20, 21. Depending on the type of EPROM being programmed, these pins will be switched to various supplies or signals by switch S1. This switch is a 4-pole 3-position rotary switch with each pole corresponding to one of the pins 18, 19, 20, 21. The three positions on the switch correspond to the three basic types of EPROM, viz 2708, 2716/2758 and 2732.

The only other switch to affect these four pins is S2. This is a DPDT toggle switch which sets the EPROM programmer into either the read or program modes. Without going into too much detail we will discuss only pins 18 and 20. Switch S2b switches pin 18 which is the program-pulse pin of the EPROM. In the read mode it switches pin 18 to ground, while in the program mode it switches pin 18 to S1c which then connects it either to the +26V or directly to the TTL level program pulses from the flipflop itself.

Pin 20 is the chip-select pin, CS/WE of the EPROM. In the read mode it will be low for all the EPROM types while in the program mode it should be at +12V for the 2708 and +5V for the 2716, 2758

The complete circuit, at right, can be built for around $75, including all hardware.


EPROM SOCKET
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
D0
D1
D2
D3
D4
D5
D6
D7
OC
CK
G1
G2
CS/WE
RESET
+12V
+25V
-5V
+5V
+26V
S1a
S1b
S1c
S1d
S2a
S2b
1k
10k
470Ω
100Ω
33k
39Ω
4.7k
2.2k
0.1
.01
Q1 BC547
Q2 BC547
Q3 BC557
Q4 BC547
*DBUSDIR
A0
A1
*RD
IN
†I/OR
*WR
OUT
†I/OW
SOLDER TO ADJACENT PIN
*IOREQ
A2
A3
A4
A5
A6
A7
*DBUSEN
*SORCERER BUS SIGNALS
†COMPUCOLOR BUS SIGNALS
VIEWED FROM BELOW
IN
OUT
GND
SWITCH POSITIONS
S1 1 : 2708
2 : 2716/2758
3 : 2732
S2 1 : PROGRAM
2 : READ
IC1 : 74LS374
IC2 : 81LS95
IC3 : 4040
IC4 : 74LS139
IC5 : 74LS04
IC6 : 74LS27
IC7 : 74LS00
IC8 : 74LS00
74LS00 VCC = PIN 14 GND = PIN 7
74LS04 VCC = PIN 14 GND = PIN 7
74LS27 VCC = PIN 14 GND = PIN 7
74LS374 VCC = PIN 20 GND = PIN 10
81LS95 VCC = PIN 20 GND = PIN 10
CD4040 VCC = PIN 16 GND = PIN 8
74LS139 VCC = PIN 16 GND = PIN 8
2708 VCC = PIN 24 GND = PIN 12
VBB = PIN 21 VDD = PIN 19
1000uF 25VW
C1
D1 1N4002
D2 1N4002
D3 1N4002
D4 1N4002
D5 1N4002
D6 1N4002
D7 12V
D8 12V
D9 5.1V 1W
A&R2155
240V
7.5V
15V
0V
LM340T-5
C2 1000 35VW
C3 1000 16VW
68Ω 0.5W
22Ω
470Ω
RED LED
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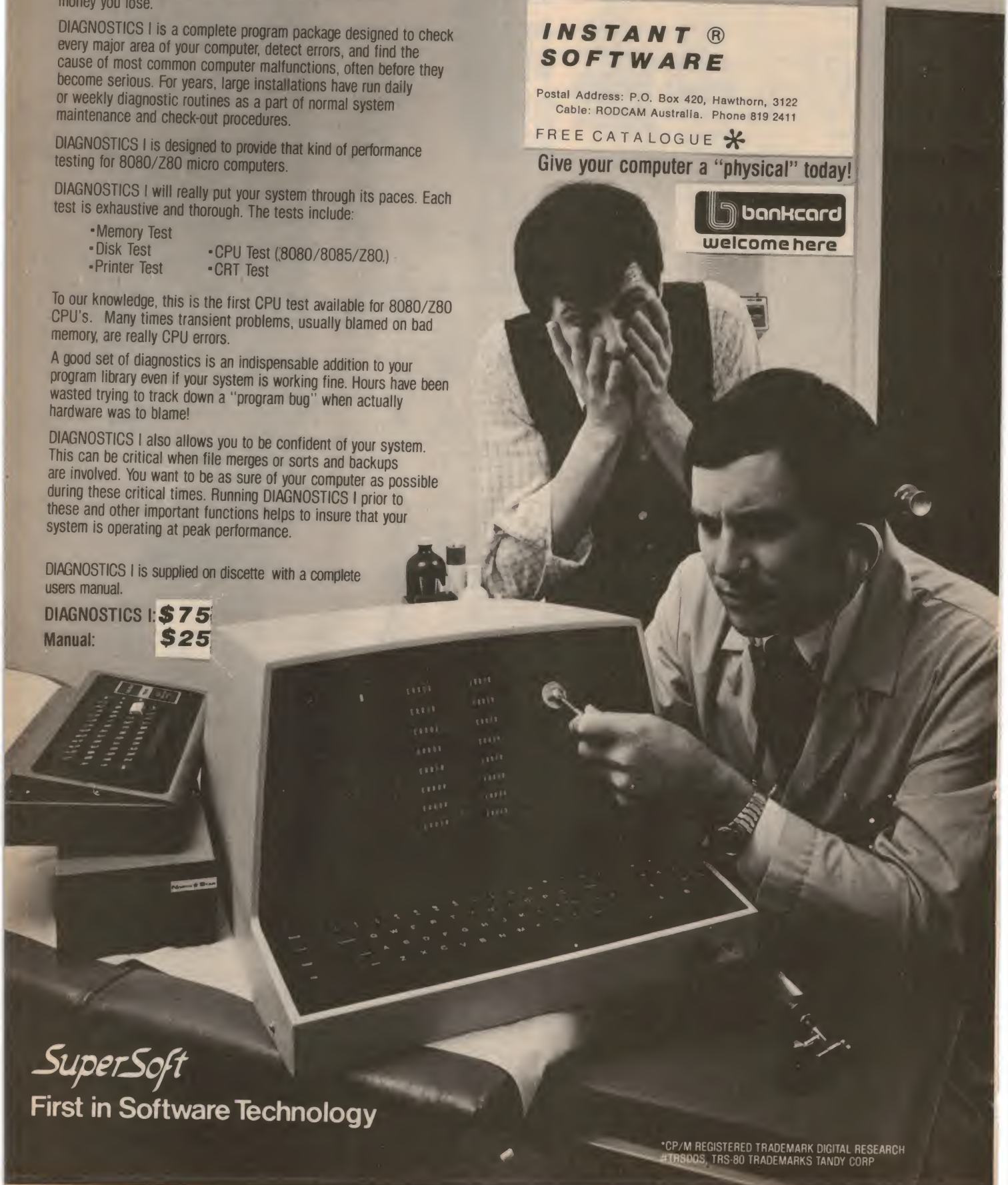

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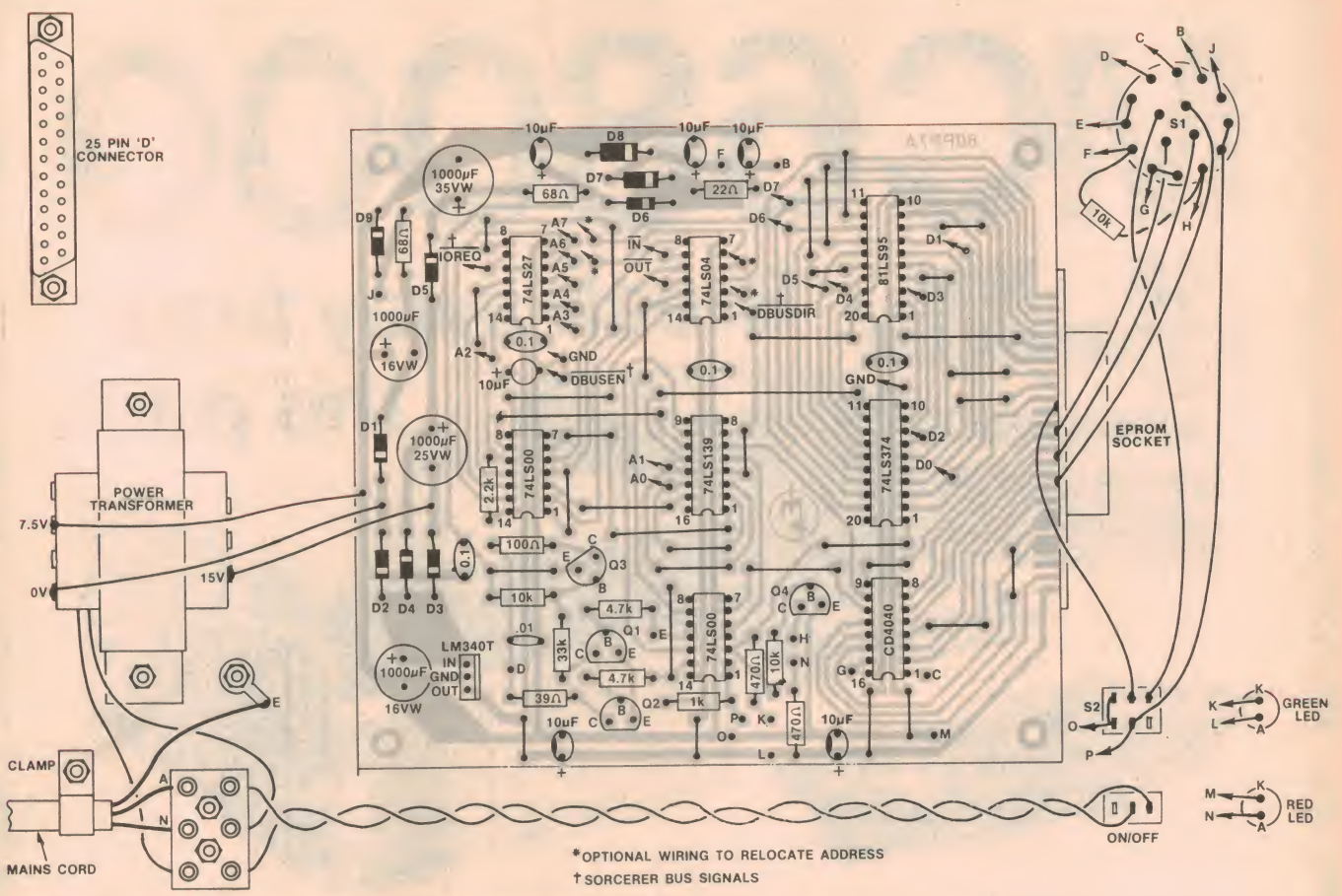

Note that a heatsink is required for the three-terminal regulator.

and 2732 EPROMs. This switching is accomplished by S1a and S2a. In the read mode, S2a is switched to ground. Hence for the 2716, 2758 and 2732 pin 20 will be low. S2a is also connected to the input of IC8a which inverts this signal, turning transistor Q4 on and hence also sending pin 18 to low for the 2708.

In the write mode the 1k resistor connected to S2a pulls pin 20 high (+5V) for the 2716, 2758, 2732 and at the same time pulling the input of IC8a high, which turns Q4 off. This results in +12V being applied to pin 20 if it is a 2708, which is precisely what is required. In addition a green LED is connected to the output of IC8d so that it turns on when the programmer is set to the program mode.

To prevent the Tristate latch IC1 from having its outputs enabled at the same time as the EPROM is enabled, the output of IC8a is connected to the output-control line of the latch, pin 1. Hence as soon as the programmer is switched to read, IC1 will be disabled and the EPROM enabled, while during programming the outputs IC1 are enabled and the ROMs disabled.

The power supply for the programmer is virtually the same as that used in a previous EPROM programmer project for 2650s and SC/MPs published February 1979 (File No. 2/CC/35). The transformer is an A&R2155 and it drives three seperate power supplies for -5V, +5V and +26V. The -5V supply is a simple half wave rectifier consisting of diode D1 and capacitor filter followed by a zener regulator using a 5.1V 1W zener.

A full-wave rectifier consisting of diodes D2 and D3 and a 1000uF filter capacitor C3, supplies an LM340T-5 three-terminal regulator. The regulator delivers a constant 5V supply with low ripple and excellent line and load regulation. The output of the regulator is decoupled by two 10uF tantalum capacitors and three 0.1uF capacitors. These are distributed around the board to reduce the effects of supply line inductance, which can be a problem due to the fast risetimes encountered with TTL.

About 30VDC is generated by a tripler circuit consisting of diodes D4, D5 and 1000uF capacitors C1, C2 together with the full-wave rectifier already described. The operation of the circuit can be understood by noting that when the 15V tap swings negative (about −10V) then the 1000uF capacitor is charged up to 20V by D4 which effectively clamps the positive side of C1 at +10V. Now when the 15V tap swings up to +10V D4 is reverse-biased and D5 is forward biased and C1's charge is dumped into C2.

The tripler is followed by a zener regulator consisting of a 68 ohm resistor, two 12V 2.5W zeners and a diode in series. Theoretically this would give a nominal output voltage of 24.6 but due to the positive thermal coefficient of the zeners this nominal voltage will exceed 25V. The voltage tolerance of the zeners also means that the actual output voltage can vary as much as ±1.4V hence this voltage should actually be checked and if it is not +26±1V then a higher or lower voltage zener should be substituted for D7.

The specified programming voltage for the 2716 and 2758 EPROMs is 25±1V which is 1V below the specified voltage range for the 2708s, viz 26±1V. Hence to keep this voltage well within specifications we have tapped off a seperate +25V supply via diode D6. The voltage at this point is 0.6V below the nominal +26V. A 22-ohm resistor has also been included in series with the +25V supply to limit the current should the EPROM selector be accidentally set to the 2716/2758 position when a 2708 is in the socket.

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MAS5694

PARTS LIST

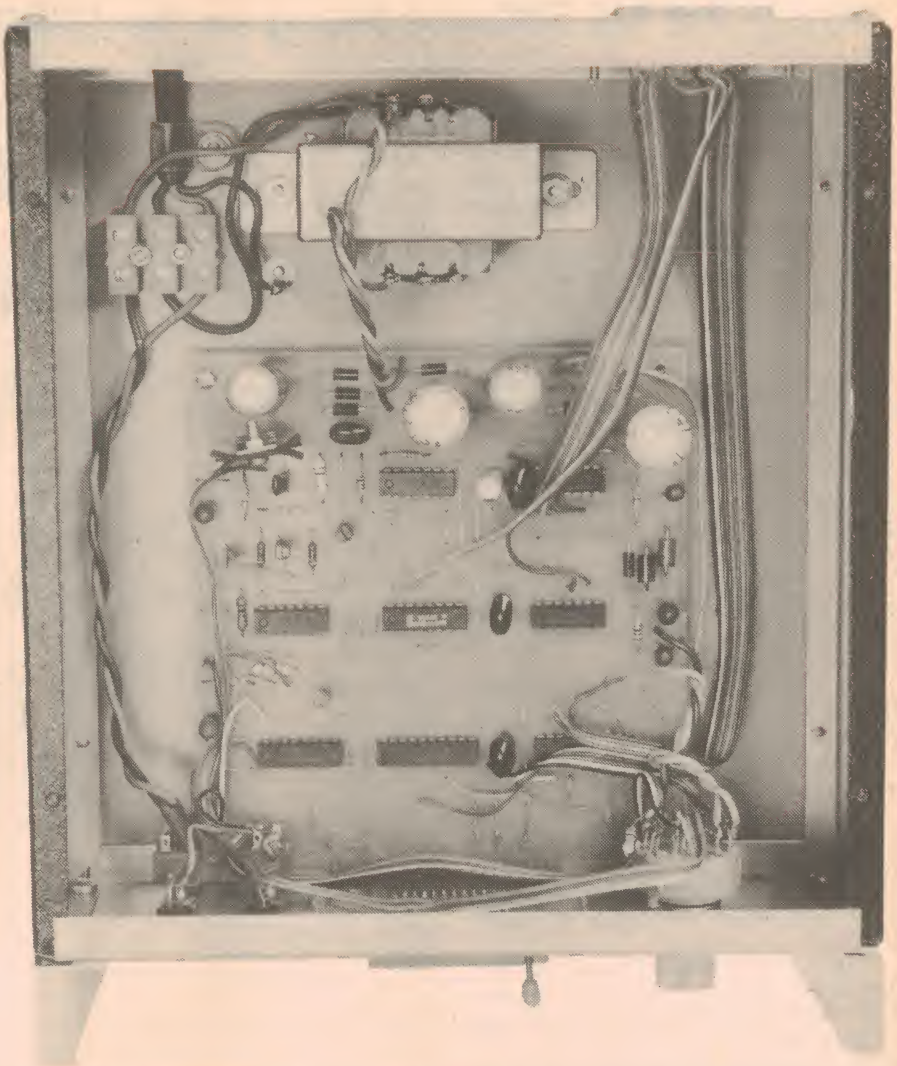
1 Horwood Instrument Case, 228 × 76 × 203mm or Pactec Instrument housing Model CH325 234 × 93 × 261mm (D × H × W)
1 A&R2155, Altronics 2155 or DSE2155 mains transformer
1 PC board coded 80pp7a, 140 × 127mm
1 PC board coded 80pp7b, 48 × 69mm
1 24-pin zero-insertion force socket
1 25-pin panel-mounting male D-connector and 25-pin female D-connector mass terminated with a suitable length of flat cable
1 20/40 way card edge connector with solder lugs
1 SPST miniature toggle switch
1 DPDT miniature toggle switch
1 3-position 4-pole rotary switch
1 mains cord and plug
1 TO-220 heatsink
1 mains cable clamp and rubber grommet
½ metre of rainbow cable
2 large LED bezels
1 large knob

SEMICONDUCTORS:
1 74LS374 octal Tristate latch
1 81LS95 octal Tristate buffer
1 74LS139 dual 2-to-4 decoder
1 74LS27 triple three-input NOR gates
1 4040 12-stage counter
2 74LS00 quad NAND gates
1 74LS04 hex buffer/inverter
1 LM340T-5 three terminal regulator
3 BC547 NPN transistors
1 BC557 PNP transistor
2 BZX70C12 zener diode
1 BZX70C13 zener diode
1 BZX70C5V1 zener diode
6 1N4002 diodes
1 large red LED
1 large green LED

CAPACITORS:
1 1000uF/35VW PC electrolytic
1 1000uF/25VW PC electrolytic
2 1000uF/16VW PC electrolytics
2 10uF/35VW tantalum electrolytics
3 10uF/25VW tantalum electrolytics
1 10uF/6.3VW PC electrolytic
4 0.1uF greencap (metallised polyester)
1 0.01uF greencap

RESISTORS (all ¼W 5%):
1 × 33k, 2 × 10k, 2 × 4.7k, 1 × 2.2k, 1 × 1k, 2 × 470 ohm, 1 × 100 ohm, 2 × 68 ohm ½W, 1 × 39 ohm, 1 × 22 ohm.

NOTE: Resistor wattage and capacitor voltage ratings are those used in our prototype. Components with higher ratings may be used provided they are physically compatible.



Terminate suitable lengths of rainbow cable to the PCB before installation in the case.

The +12V supply required by the 2708 is also tapped off the regulator by taking the voltage across zener diode D8, This is why two zener diodes were used in series rather than one single 24V zener, but it has the further advantage of reducing the dissipation by distributing the power dissipation in two 2.5W zeners rather than a larger and more expensive 24V zener.

CONSTRUCTION

That completes our discussion of the circuit. We can now discuss the construction of the programmer. The unit is assembled on two PC boards, 80pp7, measuring 140 x 127mm and 80pp7b, measuring 48 x 69mm. Most of the components are mounted on the larger PCB while the EPROM socket is mounted on the small PCB which is soldered at right-angles to the larger PCB.

Mount the links, ICs and other components on the main board first paying particular attention to the orientation of the ICs diodes and electrolytics. Next mount the EPROM socket on the socket PCB.

The EPROM socket should be a 24-pin zero-insertion force socket so as to avoid damage to the IC pins and ensure a long life for the socket. Two types of zero-insertion force sockets are available so the front panel artwork has been designed to accommodate either type. We understand that these sockets as well as most of the other parts for the programmer can be obtained from CQ Electronics, 95 Regent St, Sydney (or 30 Campbell St, Blacktown) and Radio Despatch Service, 869 George St, Sydney.

We housed our unit in a Horwood Instrument case measuring 228 x 76 x 230mm (D x H x W). The case has black Marviplate top, bottom and sides with aluminium front and back panels. Alternatively you can use a Pactec Instrument Housing model CH325 which is a particularly attractive unit though it is more expensive than the Horwood case.

Drill mounting holes for the major components and make a cutout in the back panel for a 25 pin male D-connector with solder lugs. This D-connector is required for the cable connection to the bus-expansion port on the back of the computer and it mates with a female D-connector which has been

Here is the full Software listing for the EPROM Programmer

mass-terminated with a length of rainbow cable. On the other end of the cable the individual wires have to be soldered to a card edge connector which then mates with the expansion port of the computer.

The connections which have to be made to the card edge connector will depend on which computer you are using. In the case of the Compucolor, Sorcerer and Tandy computers this information is given in the owner's manuals so we will not list them here. The only point to note is that a different size edge connector is required for each of them. The Compucolor and the Sorcerer both require 25/50 way edge connectors while the Tandy requires a 20/40 way edge connector.

Mass terminated 25-pin D-connectors are available from Radio Despatch Service, 869 George St, Sydney as well as the card edge connectors.

Now drill the holes in the front panel for the switches and LED bezels and make a cutout for the EPROM socket. Use the actual size artwork shown else where in this article to obtain drill centres etc. The artwork can also be used to make up a front panel from Scotchcal photosensitive aluminium or alternatively front panels can be purchased from Rod Irving Electronics or Radio Despatch.

The PCB can now be installed in the case using 10mm tapped spacers to support the board. Temporarily install the socket board with the zero insertion force socket into the front panel cutout and butt the main board against it. Then using a pencil, mark a line across the socket board, remove the two boards and using the line as a guide, solder the two boards together. Be careful to line up the connector strips on the boards and carefully solder two of the connector strips together. Check first to see that the boards will mount properly in the case then solder the remaining connector strips together.

With the main components mounted in the case, complete the wiring using the diagram shown elsewhere in this article. For a neat appearance use rainbow cable for the connections to the D-connector and the front panel switches.

CHECK VOLTAGES!

Rather then blow up an otherwise working EPROM your first check, after turning the programmer on, is to test that all the voltages on the power supply pins of the EPROM are okay. Some points to note when using the programmer is that the EPROMs should only be inserted into the programming socket when the power is off and the programmer has been switched to read mode. It is also good practice to check

```
10 REM
20 REM ELECTORNICS AUSTRALIA 2708 EPROM PROGRAMMER
30 REM WRITTEN BY ROM DE JONG 22/5/80
40 REM FOR THE TRS-80 LEVEL II BASIC
50 REM
60 REM THE PROGRAM CONSISTS OF A NUMBER OF
70 REM INDIVIDUAL ROUTINES WHICH CAN BE CALLED UP
80 REM SEPARETLEY IF REQUIRED. THE ROUTINES ARE
90 REM LISTED BELOW.
100 REM 1. "2000" CHECKS TO SEE THAT THE EPROM
110 REM     HAS BEEN PROPERLY ERASED.
120 REM 2. "3000" READS DATA INTO MEMORY STARTING
130 REM     AT LOCATION 30001 FOR SUBSEQUENT LOADING
140 REM     INTO THE EPROM
150 REM 3. "8000" PROVIDES A HEX LISTING
160 REM     OF PREVIOUSLY ENTERED DATA.
170 REM 4. "4000" PROGRAMS DATA IN MEMORY INTO
180 REM     THE EPROM USING A MACHINE LANGUAGE DRIVER.
190 REM 5. "6000" IS A ROUTINE FOR LOADING DATA
200 REM     FROM AN EPROM INTO MEMORY FOR SUBSEQUENT
210 REM     PROGRAMMING INTO A BLANK EPROM. HENCE IF A
220 REM     BLANK ROM IS LATER INSERTED AND RUN 4000
230 REM     EXECUTED THE FIRST EPROM WILL BE DUPLICATED
240 REM 6. "9000" IS AN EDITING ROUTINE WHICH
250 REM     ACCEPTS A HEX ADDRESS FOLLOWED BY A
260 REM     HEX DATA BYTE TO BE PLACED AT THAT LOCATION.
270 REM
1000 DEFINT A-Z
1010 GOSUB 2000
1020 GOSUB 3000
1030 GOSUB 8000
1035 GOSUB 9000
1040 GOSUB 4000
1050 Z=0:GOSUB 5000
1060 END
2000 INPUT "SWITCH TO READ MODE";A$
2010 J=INP(1):CR=0
2020 FOR I=1 TO 1024
2030 POKE 30000+I,255
2040 IF INP(0)<>255 THEN CR=1
2050 J=INP(2)
2060 NEXT I
2070 IF CR=1 THEN PRINT "EPROM NOT ERASED":END
2080 PRINT "EPROM ERASED"
2090 RETURN
3000 FOR I=1 TO 1024
3010 J=I-1:GOSUB 7050
3020 PRINT "@"+P$,
3030 A$="":INPUT A$
3040 IF LEN(A$)=0 THEN GOTO 3080
3050 GOSUB 7000
3060 K=J:GOSUB 7000
3070 POKE 30000+I,16*K+J
3080 NEXT I
3090 PRINT "DATA ENTRY COMPLETED"
3100 RETURN
4000 INPUT "SWITCH TO PROGRAM MODE";A$
4010 DATA 30,220,33,48,117,1,0,4,219,1,126,211
4020 DATA 0,211,2,62,54,61,32,253,211,1,35
4030 DATA 219,2,11,120,177,32,236,29,32,225,201
4040 FOR I=0 TO 33
4050 READ A:POKE I+32002,A
4060 NEXT I
```

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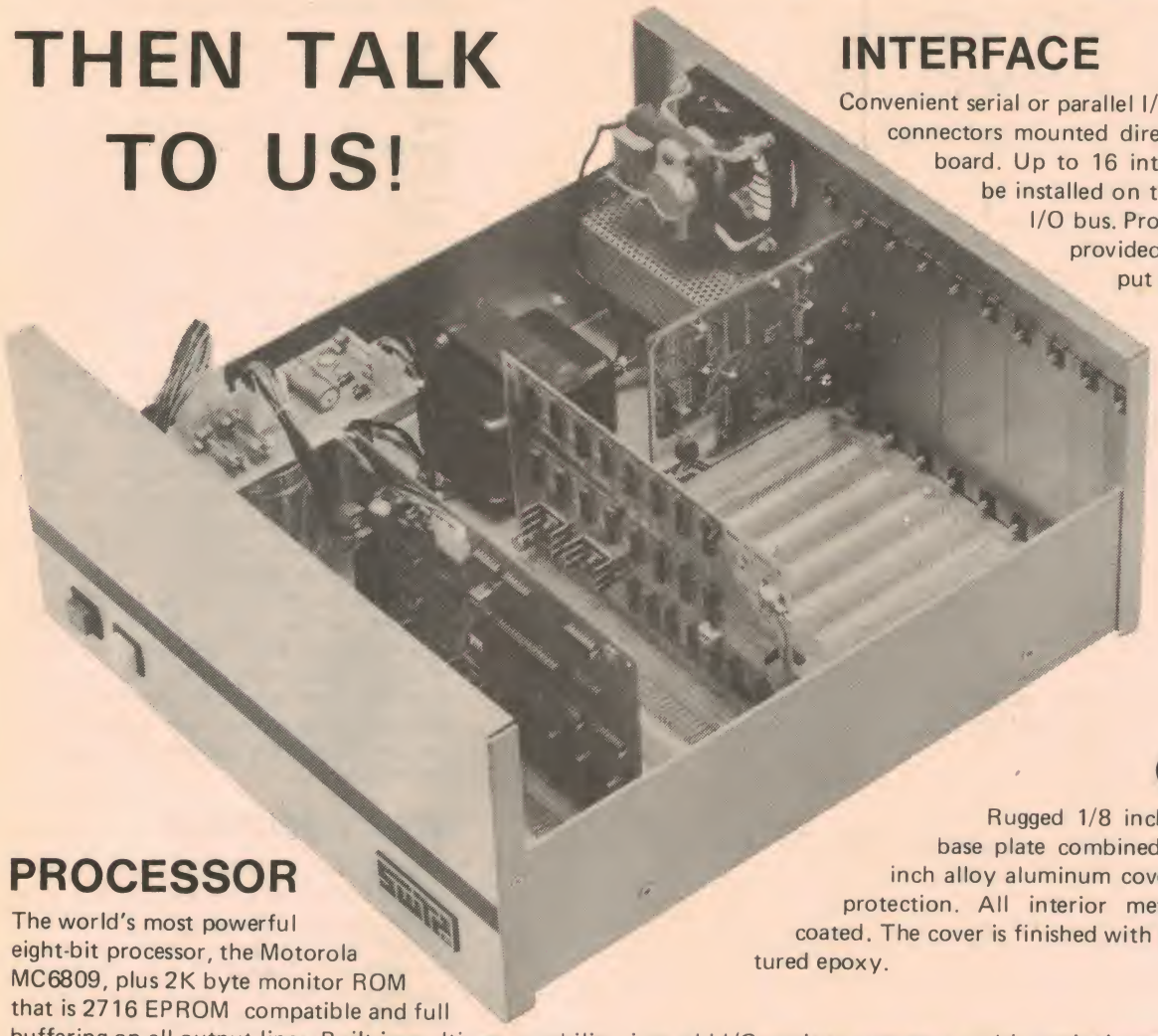

INTERFACE

Convenient serial or parallel I/O cards have DB-25 connectors mounted directly on the circuit board. Up to 16 interface devices may be installed on the address decoded I/O bus. Programming strips are provided for input and output baud rate selection on each port. All outputs are fully buffered.

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EPROM Programmer listing contd:

```
4070 POKE 16526,2:POKE 16527,125
4080 J=USR(0)
4090 PRINT "EPROM PROGRAMMING COMPLETED"
4100 RETURN
5000 INPUT"SWITCH TO READ MODE";A$
5010 J=INP(1):I=1
5020 FOR Q=1 TO 9
5030 P$=RIGHT$(P$,2)
5040 FOR R=1 TO 15
5050 J=I-1:GOSUB 7050
5060 PRINT "0"+P$+"
5070 FOR T=1 TO 8
5080 IF Z=1 THEN J=PEEK(30000+I):ELSE J=INP(0)
5090 GOSUB 7050
5100 P$=RIGHT$(P$,2):B=PEEK(30000+1):PRINT P$;
5110 IF J=B THEN PRINT"    ";:ELSE PRINT"*   ";
5120 J=INP(2):I=I+1
5130 NEXT T
5140 PRINT
5150 IF I>1024 THEN RETURN
5160 NEXT R
5170 INPUT A$
5180 NEXT Q
5190 RETURN
6000 J=INP(1):INPUT "SWITCH TO READ MODE";A$
6010 FOR I=1 TO 1024:POKE 30000+I,INP(0)
6015 J=INP(2):NEXT I
6020 Z=1:GOSUB 5010
6030 RETURN
7000 IF B$<"A" THEN J=ASC(B$)-ASC("0"):RETURN
7010 J=ASC(B$)-ASC("A")+10
7020 RETURN
7050 K=INT(J/256)
7060 M=J-K*256
7070 L=INT(M/16)
7080 M=M-L*16
7090 N=K:GOSUB 7140
7100 P$=N$:N=L:GOSUB 7140
7110 P$=P$+N$:N=M:GOSUB 7140
7120 P$=P$+N$
7130 RETURN
7140 IF N>9 THEN N$CHR$(N-10+ASC("A")):RETURN
7150 N$=CHR$(N+ASC("0"))
7160 RETURN
8000 Z=1:GOSUB 5010
8010 RETURN
9000 PRINT "EDITING INPUT FORMAT AAAA DD"
9010 INPUT A$
9020 IF LEN(A$)=0 THEN RETURN
9030 GOSUB 7000
9040 K=J:GOSUB 7000
9050 K=16*K+J:GOSUB 7000
9060 K=16*K+J:GOSUB 7000
9070 K=16*K+J:GOSUB 7000
9080 A$=RIGHT$(A$,2):GOSUB 7000
9090 L=J:GOSUB 7000
9100 POKE 30001+K,16*L+J
9110 GOTO 9010
READY
```

that the right EPROM type has been selected before using the programmer.

Well that completes the hardware.

SOFTWARE DESCRIPTION

Now all that remains before we can start programming EPROMs is suitable software for the microcomputer. To this end we have provided a listing of a program (for 2708 EPROMs only) written in Tandy Level II BASIC. The timing for the program routine assumes a 2MHz CPU clock. It is possible to adapt this program for other microcomputers and different clock speeds. Also by changing the various constants in the program and adding extra routines, 2716/2758 and 2732 EPROMs can be programmed.

There are six separate routines which are called up in sequence by the main program during normal execution. These routines are as follows: "2000" checks that the EPROM has been erased; "3000" reads the data to be stored in the EPROM by first prompting with the hexadecimal address and then reading the hex data to be stored there – note that this data is stored in the computer's memory at this stage; "8000" lists the data which has been entered in the form of a hex dump with a hex address then eight hex data bytes per line. The listing is page by page so that each page of data can be individually studied and any errors noted.

UTILITY ROUTINES

If there are any errors these can be corrected in the next routine. This is an editing routine starting at "9000" which accepts input in the form of a four-digit hex address followed by a two-digit hex data byte which is to be stored at that location. Routine "4000" is then called and this loads and jumps to a machine language program that takes the data stored in the computer's memory and programs it into the EPROM. This routine is quite fast and as we have mentioned, programming time is about two minutes or less.

The programming routine is followed by a verification routine which provides a hex dump of the data contained in the EPROM and marks any data bytes which do not match the data stored in the computer's memory with an asterisk. (If there are any bad locations then the EPROM may be faulty.)

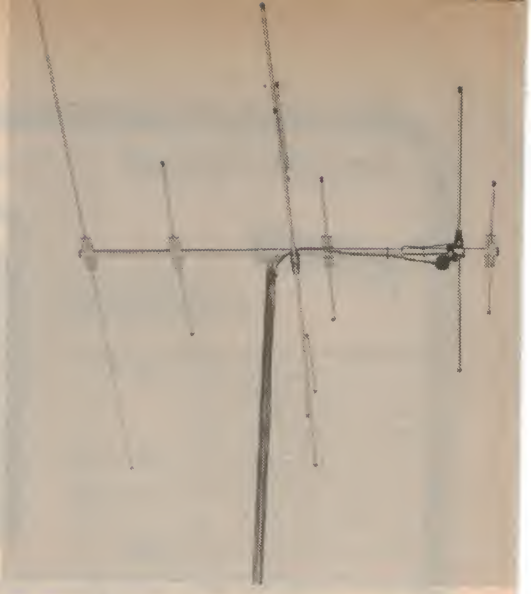
In addition to these, we have provided another routine at line 6000 which may be called up to read the data from an EPROM into the computer's memory and list it in the form of a hex dump. This is useful for duplication of EPROMs since if routine "4000" is then called this data can be programmed into any number of blank EPROMs which are subsequently loaded into the programmer.

Next month we shall feature a listing of this program for the Exidy Sorcerer.

(To be continued)

It cost you money, so...

Take care of your TV/FM antenna



In the interest of signal pickup, a television antenna should be mounted well out in the clear. But, in such a position, it is exposed to wind, salt spray perhaps, and large birds. The Author, an expert in the field, talks about possible deterioration, and damage to TV antennas.

by W. J. (Bill) McMANUS*

Corrosion, or oxidisation, is one of the main enemies of a TV/FM antenna installation but it is one that depends a great deal on the particular location.

In the dry Australian interior, a piece of steel without special protective coating may last for years without showing signs of destructive corrosion. On the other hand, corrosion is a very real problem in coastal regions, such that all hardware that is used to support the antenna should be hot-dipped galvanised.

Nuts and bolts need to be zinc or cadmium plated – a treatment that offers protection without affecting the thread. They could be galvanised but a die nut would have to be run over the thread and this would cut the coating off and leave bare metal again.

Brass bolts are out of the question because of the electrolysis effect that would set up immediately with the galvanising, leading to chemical corrosion.

Aluminium nuts and bolts are less prone to electrolysis but they lack the strength of the harder metals.

Stainless steel hardware is both strong and virtually corrosion-free but the cost will deter most ordinary consumers.

Fortunately, the life of antenna support hardware can be prolonged in badly affected salt areas by first treating it with a metal primer and then coating it with a good quality weather-resistant paint.

The antenna itself is normally less of a problem. Being constructed mainly or wholly of aluminium, there is no spontaneous galvanic action between the various components. Other reasons for using aluminium include:

- Its light weight, especially when large arrays have to be installed at a considerable height in fringe areas. Apart from problems of handling, weight imposes demands on the supporting structure.
- The electrical conducting properties of aluminium are good.
- Aluminium has good anti-corrosion properties, even in a coastal environment.

After aluminium has been exposed to the weather for some time, its skin hardens to produce a coating not unlike anodising, thus acting as a form of self-protection. However, when subjected to direct salt-spray (eg within 100 metres or so of the water's edge) severe deterioration can still occur.

Coating the antenna with protective lacquers etc, can slow down this action a little but it has to be done correctly. Ordinary metal primers do not take well to aluminium. It has to be etch-primed, undercoated, and a special aluminium paint applied.

Care has to be taken not to paint the insulators and connections. These are best treated with a rubberised compound laid on liberally to keep the salt water etc away from the connections by sealing them over.

All stainless steel antennas can be used in coastal situations but, again, the cost is high.

As distinct from corrosion problems, medium to large birds can pose a constant hazard both inland and on the coast. Cockatoos and galahs have been known to chew the insulators away on an antenna in inland situations and, on the coast, large water birds such as pelicans have used television antennas as a spotting position for fish, if situated close to an estuary.

Unfortunately, an antenna constructed strongly enough to withstand the stress of a pelican landing and taking off again would be just too heavy and too costly to market. However, an idea that offers some protection is to provide the birds with an alternate perch, which can be in the form of a "T" bar arrangement that projects above the antenna (at least a half wavelength so it won't interfere with the electrical performance). With a stronger and larger horizontal section on top, the larger birds favour sitting there rather than on the thinner elements.

Probably the worst enemy of a large TV/FM antenna installation is gale-force wind. In theory, an antenna could be constructed that would withstand anything that the elements might throw at it but, as mentioned earlier, it gets down to matters of weight and cost. Even so, given sufficient thought and care, a normal system can be installed so as to stand up to anything short of a typhoon!

The main reasons why antennas blow down are as follows:

1. The guying angle is too acute to give proper support to the mast. There are calculations that can be carried out for wind loading on the antenna and supporting mast etc but it is outside the

"And that guy wire thing just happened to get caught in the bumper bar!"

*Bill McManus is Managing Director of Hi-Q Television Services Pty Ltd, 69 Maitland Rd, Islington, NSW 2296. The article is adapted from his book "TV & FM Aerial Installations for Australian Conditions", as reviewed on page 102 of our May 1980 issue. Price of the book is $4.50 plus postage.

scope of this article to go into them. A good rule of thumb is never to install the guying points closer than a third of the height of the masts. If you are going up 15 metres your guying points should be five metres or more from the foot of the mast; the wider the better, within reason.

2. Improperly placed guys. Aim to install four sets of guys, arranged 90° apart.

3. An unsupported top section carrying the antenna itself. A special collar on all High-Q masts allow an extra set of guys to be installed right up underneath the antenna.

4. Insecure anchor points. Use eye bolts wherever possible, locked in position with a washer and nut. Failing eye bolts, and the need to use a guying cleat, use coach screws. Above all, don't count on the fascia board of an old dwelling; it may be quite insecure.

5. Corroded and weakened guy wires, eye bolts, turnbuckles, etc. They should be checked every two or three years.

As there is such a wide variety of situations encountered when installing television antennas, there is no set rule of how each one should be approached. A lot of initiative and common sense, has to be used.

One only has to glance at some installations to get the impression that they are not safe. Examples are on the roof of a gunbarrell type house; or on the ground with the fence too close to the dwelling. In both cases the guying angle is such as to impose too much down-thrust on the mast. This may cause it to buckle, usually between the upper guy rings.

Standards have been published concerning such matters but, if these are not to hand, let common sense be your guide. Don't go for greater antenna height, in search of a better picture, if you can't provide adequate guying. And don't forget that wind gusts can be stronger in some situations than others.

CLIMBING THE MAST?

One final point: to save time and expense a professional antenna man may opt to climb an existing installation to check for a broken lead or install a masthead amplifier. He has experience and maybe equipment on his side, so don't be tempted to follow suit out of sheer bravado.

But, if you're determined to copy the expert, first carefully check all guy wires and all anchor points; and make sure that there is enough of them to cope with the extra stress.

Check the mast sections carefully as you progress. They tend to rust from the inside, leaving only the galvanised shell.

Believe it or not, I have known an installer to poke a screwdriver straight through an apparently solid looking metal mast. That would be one case, for certain, where care paid dividends!

The Serviceman

There's a signal somewhere - in them thar 'ills!

As a change from intermittents and similar horrible beasties, this month I have a story about a different type of serviceman activity; the installation of a complex antenna system in a difficult fringe area. There is also some insight into customer attitudes and psychology.

The story comes from a colleague in the channel 4/5A region south of Sydney, where long distances and undulating terrain make reception difficult or impossible for many outlying properties. I will present it more or less in his own words, as he told it to me.

The customer and his wife lived on a cattle stud property a few miles out of town and I first met them several years ago when I was called to service a monochrome TV set. The fault was a routine one which was quickly fixed, but I was rather shocked – though not surprised – at the quality of the picture. As well as severe snow, it displayed several prominent ghosts.

The reason was fairly obvious. The antenna was a very simple one supported by a short mast on the bargeboard. That was bad enough considering the distance involved, but the real problem was the location. The house was situated hard in under a steep hill, directly between it and the transmitters.

It was so bad, in fact, that I was surprised that they received any picture at all, but even more surprised that they could bear to watch it. I commented on the picture quality, feeling that a higher mast might be worth trying, but they seemed quite content with things as they were; so I didn't press the point.

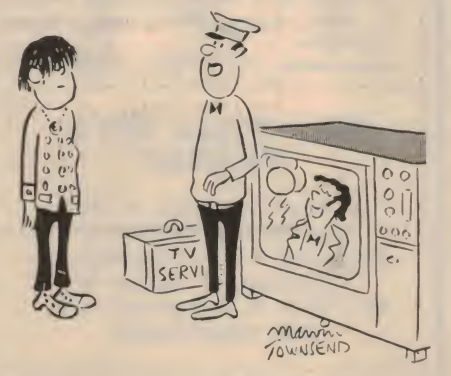
I visited the property several times over the next couple of years, mainly to fix routine faults. On one occasion I found that the reflector and one director had fallen off the antenna, making the picture even more atrocious than before. Even so, it took some effort to persuade the customer to let me fix it.

More recently he asked me to bring out a colour set for a trial, which I did, but the result was a foregone conclusion – hopeless. In vain I tried to persuade him to think in terms of a better antenna but he finally decided that the monochrome set was good enough.

It was nearly two years before I saw him again, and I found that there had been a change in the domestic scene. His wife had passed away a few months earlier, and a married daughter, with two small children, had moved in to keep house for him.

I have no doubt that the presence of a younger woman, and the two children in particular, in the isolated environment, was responsible for my being called in and the changed attitude which I found. For one thing, the daughter had brought her own colour TV set with her and found, to her dismay, that it was quite useless.

My next surprise was the farmer's attitude. He came straight to the point with the question, "What can you do about it?" Remembering his previous reaction, I hesitated to make any drastic suggestions. I felt that if I could persuade him to install a reasonable mast and high gain antenna it would be about as much as I could expect.



"To get the picture really clear, I'll need a pair of scissors!"

We sat down to discuss the problem over a very welcome cup of tea, and I outlined some of the possibilities, their likely cost, and probable order of improvement. I was surprised to find that he now seemed prepared to spend almost any reasonable amount of money if I could promise a worthwhile improvement.

But now I was trying to decide whether to "go for broke". I had always envisaged the ultimate installation for this site; an aerial on top of the hill which shielded the house, a masthead amplifier, and open wire feeder to the house. I was sure it would work, but I hesitated to suggest anything so costly.

So I decided to try a little psychology. If I could make the customer believe he thought of the idea, then he might well buy it. So, while we discussed the problem, I jokingly pointed out that his house was really in the wrong place; that if it had been up on the hill he would have no problems.

He took the bait. "Could we put the antenna up on the hill?" he asked innocently. Inwardly delighted, I agreed that he had made a very good point (thus giving him the credit) and that it would be well worthwhile surveying this area and working out installation details.

I resolved to strike while the iron was hot. I had brought antennas, portable masting, field strength meter, etc with me, and I decided to survey the area right away. So I set off up the hill, hoping I could find a spot which was a reasonable compromise between the view towards the transmitters and the distance to the house.

As it turned out, I found a very likely looking spot. Setting up the field strength meter I fitted a four element aerial to a 5-metre length of masting and made some measurements. The results were excellent; over 2mV on channel 4 and about 1.2mV on 5A.

Back at the house I told the customer what I had found; a really first class signal which should give him a perfect picture. By now he was almost as excited as I was, but I wasn't prepared for his next suggestion. "Would it be possible to

operate more than one set from such a system?"

I assured him that it was possible, little realising how the situation was about to mushroom. He then reminded me that he still had the monochrome set, and went on to explain that his daughter had also brought a monochrome set with her

So now he wanted three outlets; one for the colour set in the lounge room, one for a mono set in his office, and one for the other mono set in the children's room!

More determined than ever to follow through, I set to on the spot and worked out the kind of amplifier I would need, the amount of cable, the splitters, antenna and mast.

It wasn't cheap by any means, but he didn't fall down in a dead faint. Rather he suggested we discuss it over another "cuppa". Then he explained that he had remembered that he had yet another monochrome set; again faulty, but which he felt confident I could repair.

It was a much older set and had been relegated to an outbuilding; an ex-army hut used as a residence for casual workers. It had never performed well on its simple antenna and, when it broke down, it was not regarded as worth fixing. But now – could I put a fourth outlet in the army hut?

The hut was some distance away from the house, but right on the line where I planned to run the feeder. I told the customer that it should not cost a great deal more to do this.

Then, to clinch the deal, I explained that with installations of this kind, I offer the customer complete satisfaction or no charge. It is not an offer one can afford to make lightly, but I have never had an installation backfire. The result was a firm order for the full installation.

On the way back to the shop I could not help but reflect on the customer's changed attitude; from an unwillingness to spend even a few dollars on a better antenna, to an almost carte blanche approach.

At the shop I went over the technical specifications again. I had selected a masthead amplifier, marketed by Standard Components, having a gain of 20dB. From this figure I subtracted the two main losses in the system; that of the open wire line and the splits to the various outlets.

I had added up a feeder length of 210m. Open wire feeder loss at 200MHz is about 0.5dB per 30m when dry, and 1.5dB when wet. This worked out at 3.5dB when dry, and a little over 10dB when wet.

This would leave a gain of 10dB at the end of the run, before splitting. A two-way splitter will introduce nearly 4dB loss in practice, and a three-way type over 5dB. It is sometimes more convenient, and cheaper, to use two 2-way splitters in cascade to provide three outlets, particularly if it is desired to favour one outlet.

Even allowing for this, the maximum

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loss would be 8dB, leaving a gain of 2dB over the signal at the aerial. Since this was already above 1mV (which I regard as a conservative minimum) this provided a useful safety margin.

There was only one snag; the branch feed to the army hut. I had overlooked the fact that I could not fit a conventional splitter at this point because of the need to feed DC power to the masthead amplifier. (I understand that splitters suitable for this application are now available, but I knew of none at the time.)

I considered locating the power supply in the hut, or running another feeder back from the house, but either would have been inconvenient and costly I decided to get the main section working first, then try some fiddling.

The actual installation, while simple enough in theory, presented some practical complications. The antenna proper presented no problems. I used a four element type similar to the survey model which, together with the amplifier, was mounted on a 5m length of masting. The latter was securely bolted to a stout fence post which just happened to be in a suitable spot.

From here I planned to run the feeder to a large tree, about 30m away, and right on the edge of a very steep drop down the side of the hill. The feeder would then run some 65m to a disused power pole alongside the army hut, and then via a couple more existing poles to the house.

Getting the feeder down the hillside was the major problem. The entire hillside was covered with a huge patch of blackberry bushes, over 3m high in most places. It reminded me of the berry picking expeditions of my youth, when we used to collect the luscious fruit by the kerosene tin full — despite the hazards of thorns and snakes!

While I was able to reach the top of the hill by a much longer path around the blackberry bush, this path was out of the question for the feeder. I tackled the job with a stout pair of boots, a boiler suit, and two ladders — another legacy from my berry picking days.

Starting from the top, I used the ladders to smash the bushes down and clear a path. I pulled a light rope behind me and, with the path cleared, I set up a drum of feeder cable on the hill and used thr rope to pull the cable down to the first power pole. The far end was then connected to the antenna and anchored on the tree as planned.

From the pole to the house was a fairly simple run and I soon had the feeder anchored on the house. Inside the ceiling I connected it to the existing 300 ohm feeder, which ran to an outlet in the lounge room. This was a convenient place to put the power supply, to feed power up the line to the masthead amplifier.

This particular power supply offers a choice of either two 300 ohm outlets or one 72 ohm outlet, and I selected the latter. I prefer to use co-ax for multiple runs, since it minimises the risk of local oscillator radiation from one set being coupled into another run.

The 72 ohm output from the power supply was taken to a two-way splitter, one split going to the children's room at the rear of the house, and involving quite a long run. The other split went to a second splitter, one split from which fed the colour TV set in the same room, and the other the second monochrome set in the office, only a short distance away.

On test, all three outlets provided a nice clean signal with level to spare, making it three down and one to go — the army hut. The signal was quite strong at this point, being only half way along the feeder, and not having suffered any splitter losses. I was hoping that a very light coupling would provide enough signal, without robbing the other sets, or creating standing waves.

I had terminated the feeder at a terminal block inside a weatherproof housing on the nearby pole, with the house feeder connected directly to it. The feeder to the hut was terminated at an adjacent pair of terminals and, as a first attempt, I bridged it across to the main feeder via a pair of 5pF capacitors.

Unfortunately, my worst fears were realised. There was far more signal being directed into the hut than was needed, the signal to the house was seriously attenuated, and there were clear indications of standing waves.

It was the amount of signal reaching the hut which suggested the next idea. If there was all that much signal available, did I need any coupling devices at all? Would there be sufficient random coupling? I took only a few moments to remove the capacitors and try again. And it worked. There was more than enough signal reaching the hut, and without any of the adverse loading effects on the main feeder.

So there it was. Not very scientific perhaps, but eminently satisfactory.

Naturally, the customer was delighted, and even smiled as he wrote the cheque. But I couldn't help wondering whether he regretted all the years he watched those atrocious pictures.

Well, that's my colleague's story, and I feel that it gives a good insight into the practical problems associated with such a project. Obviously, one needs to be a technician, mathematician, psychologist, mountain climber, and blackberry bush trampler, all rolled into one.

No wonder such installations are expensive!

CIRCUIT & DESIGN IDEAS

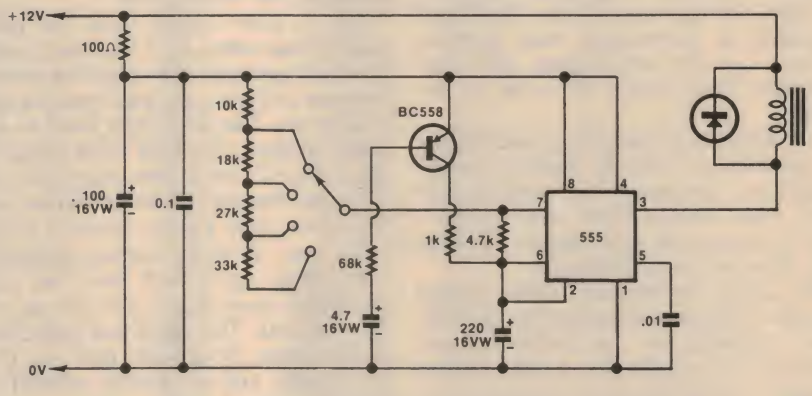
Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Contributions to this section are always welcome, and will be paid for if used.

Conducted by Ian Pogson

Simple modification to wiper delay unit

This simple and inexpensive modification may be added readily to the Wiper Delay Unit described in September, 1979.

With the original circuit, the first delay time after switch on was longer than the selected time interval. This meant that the wipers had to be manually switched to clear the screen. The addition of a series RC network and a transistor charge the timing capacitor immediately power is applied, thus giving two or three wipes to clear the windscreen. For the first 15 seconds the delay period is slightly shorter than usual as the timing capacitor is charging both through the timing resistors and the partially conducting transistor.



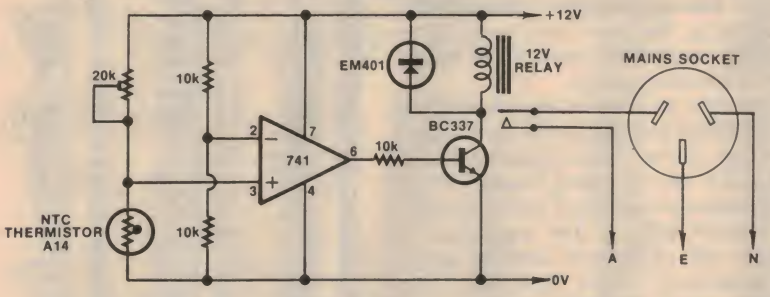
The 4.7uF capacitor should be a tantalum type to ensure low leakage. The number of initial wipes can easily be changed by altering the values of the 68k resistor and 4.7 capacitor.

(By Mr C. Hall, 2/60 Lang Road, Centennial Park, NSW 2021.)

Temperature control for heaters

This circuit will switch any 240V heater on when the temperature drops below a preset level and switch it off again when the room warms up. The NTC thermistor has a resistance of about 10k at 20°C. Other thermistors may be used provided that the value of the variable resistor is twice the value of the termistor at 20°C. This will allow a broad range of temperatures at which the heater may be operated.

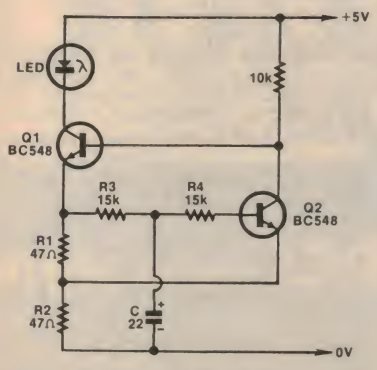
The 741 op amp is used as a comparator. The two 10k resistors form a voltage divider to supply six volts at the non-inverting input of the 741. As the temperature drops, the resistance of the thermistor rises and the voltage across it increases. When the voltage goes above six volts, the output of the comparator will saturate and go to 12V. This will forward-bias the transistor and cause the relay to become energised. The heater is turned on via the relay contacts.



The relay contacts must be rated for 240V AC and at 10A, or for whatever the particular application may require.

(By Mr J, Petroulias, 30 Whitehorse Road, Blackburn, Victoria.

A simple LED flasher



If a flashing LED is required this circuit is simple and effective. A Schmitt trigger provides regenerative switching and R1 gives the necessary charge/discharge bistable action as Q1 is switched on and off. Resistors R3 and R4 set the on and off times respectively and the best ratio seems to be 2:1. The values shown give an oscillator frequency of about 1.5Hz. Brightness of the LED is set by R1 and R2.

(By W. C. Peaston, in "Wireless World".)

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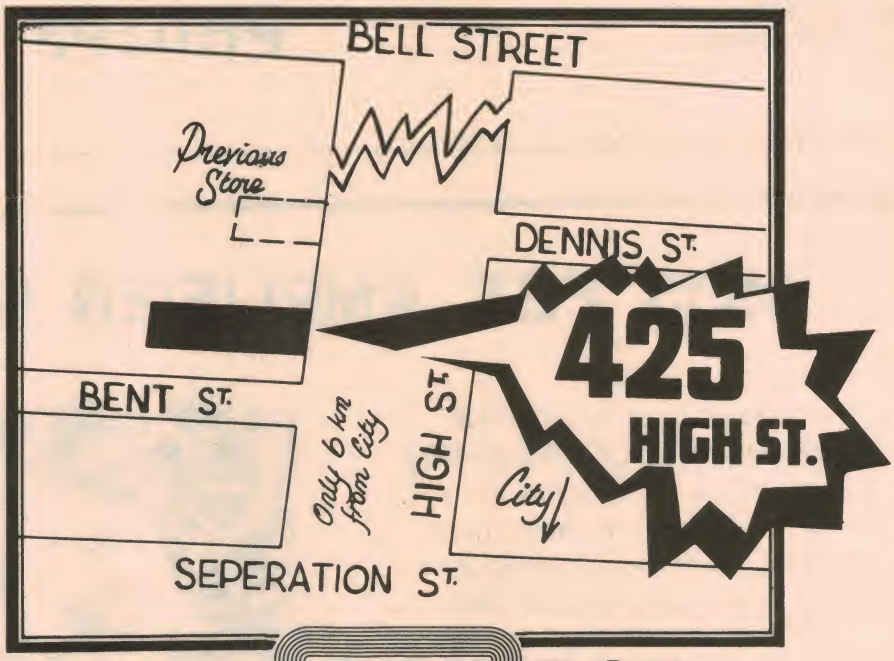

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Inside a handheld hairdryer

Basic Electronics

Have you ever wondered how they fit a powerful motorised fan, a heater and control circuits inside the compact case of a modern handheld hairdryer. A look inside shows that they are an interesting application of basic electronics principles.

by PETER VERNON

The most expensive and heaviest component of larger hairdryers is the motor to drive the fan. The fan motor needs to be reasonably powerful in order to deliver a concentrated blast of air right to the roots of the hirsute mass on the user's head.

Larger hairdryers, such as the bonnet type, generally use a shaded-pole AC motor, while the older "heat-gun" type of hand-held dryer often use a "universal", or series wound AC/DC motor. Both sorts of motors are quite difficult to manufacture below a certain size, and they lack sufficient power.

The "slim line" style of hand-held hairdryer, illustrated here, gets around this problem by using a small permanent-magnet DC motor. These motors combine small size with the power required to drive an efficient tangential blower fan.

This DC motor is powered directly from the mains via a bridge rectifier. The heating element itself is used as a series limiting resistor to drop the mains voltage for use by the motor. The circuit diagram illustrates the concept.

Power is applied to the dryer through a three-position switch. The heating element is actually tapped, and the bridge rectifier fed from the tap to produce approximately 15V DC (unfiltered) for the fan motor.

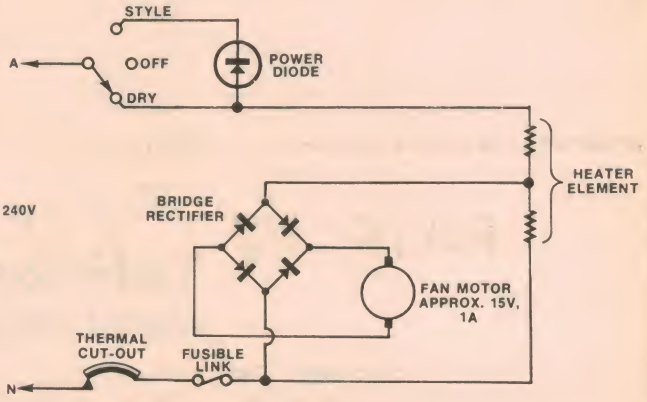
Speed and temperature selection are provided for the dryer by a simple method. When the three position switch is in the "dry" position, the full mains voltage is applied to the heating element, to produce a high temperature and a high fan speed.

When the switch is in the "style" position the mains voltage is half-wave rectified by a power diode before it is applied to the heating element. This half-wave rectification cuts the mains voltage to approximately 170V RMS, reducing the power to the heating element by half. The voltage to the motor is reduced by a proportionate amount, causing it to run at a slower speed.

Great attention has also been paid to safety in the design of hand-held dryers. They are double insulated — even the switch is operated by a sliding plastic cover plate. A thermal cut-out is provided in the form of a bi-metallic strip mounted near the heater coil, and there is a fusible link in the power supply wiring.

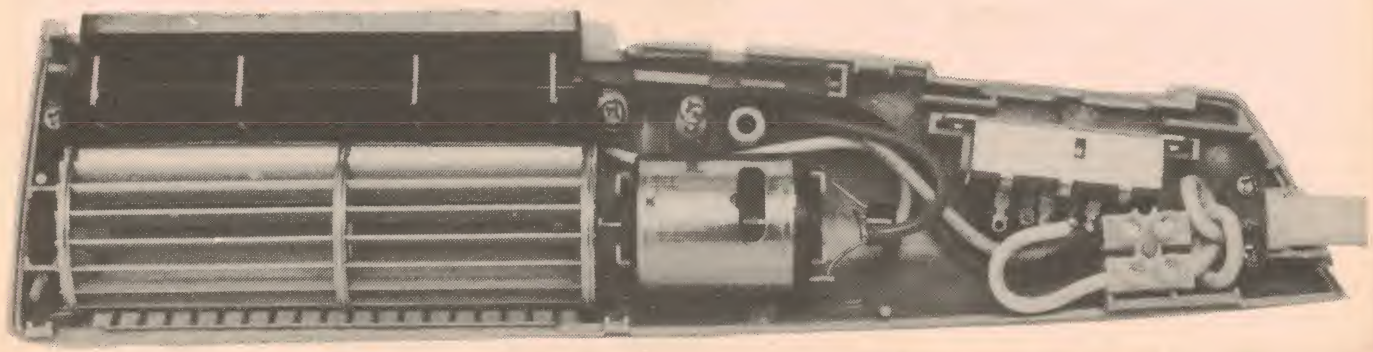
All told, these new lightweight hairdryers are an ingenious application of simple electronics circuitry to produce a highly effective product.

And just before we conclude, here is an interesting idea. That fan and motor could be very useful for forced air cooling in a high power amplifier or computer power supply. When run from 12VDC or less it should be reasonably quiet but still deliver a copious quantity of air. Think of that possibility if ever you come across a discarded unit.



The fan motor is run from a bridge rectifier connected to a tap on the heating element.

That compact DC motor in the dryer below delivers a really copious flow of air from the efficient blower.



Letters to the editor

Error on May front cover

I would like to draw your attention to an obvious error on the front cover of the May 1980 issue of "Electronics Australia".

You say on Page 1 under the heading "On the Cover" that well known organist Klaus Wunderlich appears with the Wersi "Galaxy W45KT" kit organ.

I have been a very keen collector of the recordings of master organist Klaus Wunderlich for some years now and I have a special half-hour weekly program on our local FM community radio station 2NCR-FM each Friday night from 7.00pm to 7.30pm, called "The Sound of Klaus Wunderlich" and I consider myself a bit of an expert on this artist.

The picture on the cover is NOT Klaus Wunderlich. There is absolutely no resemblance to Klaus what-so-ever. The picture is more like another very popular German organist, Franz Lambert.

I am enclosing a picture of Klaus Wunderlich for your perusal and comparison. I feel sure that you will agree with me that the caption for your cover is incorrect.

Bruce A. Greig,
Lismore, NSW.

COMMENT: You are quite right. On checking back with Peter Hadrian of Defi Agency, we find that the organist is indeed Franz Lambert. The confusion arose because Klaus Wunderlich was featured in the demonstration record mentioned.

Judge not, or you too . . .

In view of the criticism of me levelled by Mr Hartkopf (Letters, May 1980), I feel some need to make restitution.

It must be said that I was not criticising Mr Reid (notice I did not mention his name), but merely asking why the program was published. Needless to say, my earlier programs would be laughable when compared with the programming abilities of, for example, Jamieson Rowe or Ian Binnie. I do not "despise" beginners; rather, in several ways, I am involved with coaching them in 2650 programming.

I agree with Mr Hartkopf's comment that it is easier to amend a program than to write one, and I apologise to him, Mr Reid, and other offended readers for the arrogant manner in which I expressed my objections.

With regard to the Reaction Timer program:

- The 300 baud modification that Mr Hartkopf criticises has appeared twice in EA: see Feb '79 p69 and Aug '79 p89.
- The other confusion is regarding output procedures. Without the modification, the program requires serial output routines COUT, CRLF and BOUT changed to another suitable output routine at 300 baud. The addresses to be changed are 055F, 052A, and 0552. (I neglected to mention this second change in the original article – sorry). The better alternative I offered was to use output port C instead of the serial output (much faster), which requires changing 0527 onwards as detailed.

And the moral of the story is: "Do not judge, or you too will be judged." (Mathew 7:1)

David Fulcher,
Strathfield, NSW.

Technology & social impact

Three cheers to Leo Simpson for his inaugural editorial – "Technology isn't everything" (EA March 1980, p3). Such sentiments remind me of my years in university when I loathed having to do "General Studies" subjects (eg Political Science, Economics) to complete the science course requirements. But now, it is those subjects which have proved to be the most useful in providing, as Leo says, a perspective on living in Australia, and the role that technological advance should and should not play in our society.

I would like to encourage "Electronics Australia" to pay more attention in its pages to the social questions raised by ever more sophisticated technology. Surely this can be done without becoming embroiled in the politics of it all. It is significant that two governments of opposite political persuasion both have enquiries or ministries dealing with these questions (eg The Technological Information and Research Unit in NSW). Even if attention was simply drawn to significant publications and articles appearing from time to time; symposia; lectures etc, I feel this would be a good thing.

Too often (I feel) the magazine, in its outlook, particularly as seen in the "News Highlights", promotes the wrong sort of fascination with scientific achievement: namely a "golly-gee-whiz" attitude which views the implementation and use of all new products and technologies as an accepted and good thing. An "I can't wait to get my hands on one of those" type of attitude.

Perhaps it would feel a little strange for a magazine which depends for its very existence on technology and its advancement, to be concerned with issues which may finally give a negative judgement on some technology and/or its introduction. But then it is "Electronics **Australia**," and a concern for Australia and Australian people in the light of the new technologies is surely in order. You have already shown this concern with articles on conservation and alternative energy sources: eg wind power, solar energy. Also articles and reports on the use of electronics in helping handicapped people have been much appreciated.

To change the subject completely I would like to make a suggestion for a constructional project: a tuning standard for guitars etc. I have seen them in shops selling for around $100-$150. I am not exactly sure how they work, but it appears you can switch them to the desired note, then tune the music instrument while watching a meter which somehow tells you when the correct frequency is achieved.

So then, keep up the good work; I really look forward to that first Monday of every month.

Robert J. Morsillo, B.Sc (NSW) B.D. (Melbourne), Pascoe Vale Sth, Vic.

COMMENT: Our February editorial was also branded "a little strange". A tuning standard for musical instruments appears in this issue.

More on cigarette adverts

John Jacobs' letter (EA March) jogged my memory to write to you about cigarette advertising in EA.

I didn't see the February issue but your "comment" to the above letter refers to something not raised in Mr Jacobs' letter – legality.

Those of us concerned enough to raise objections to cigarette advertising in publications such as EA are not convinced by such weak "justifications". One would have to be senseless to eschew the common sense and scientific findings linking smoking and clinical disease.

You have the right of choice to allow cigarette advertising or not. In my opinion you have not made the right choice.

John Reid,
Wyoming, NSW.

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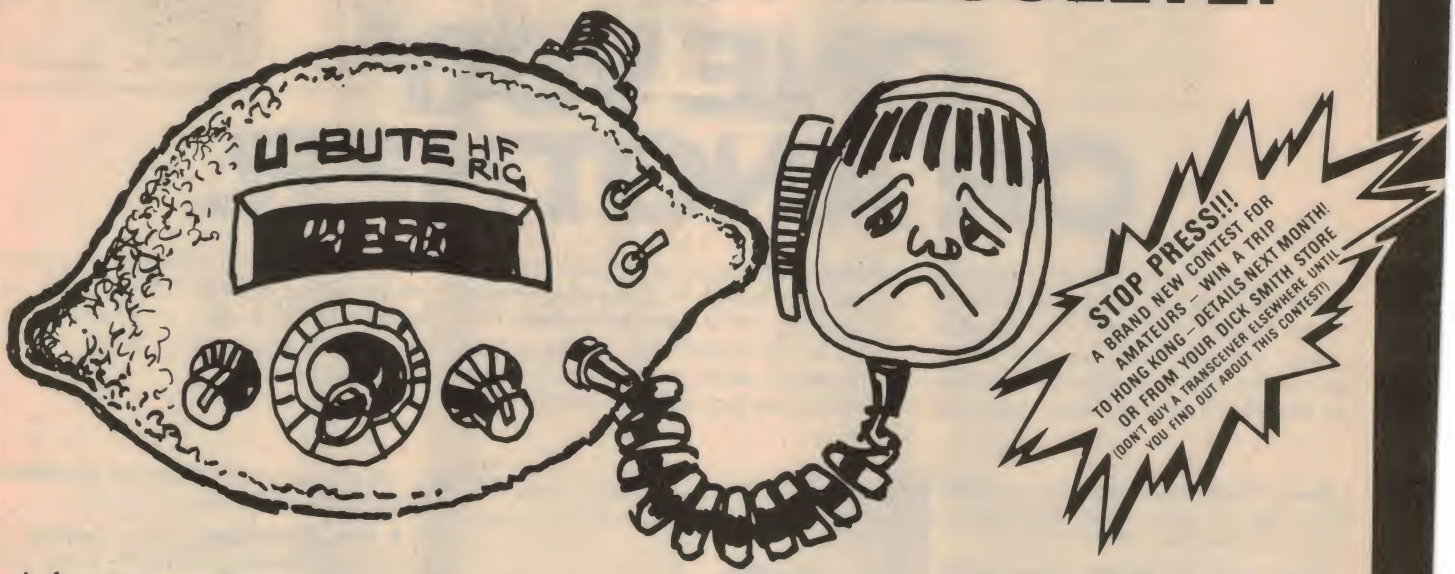
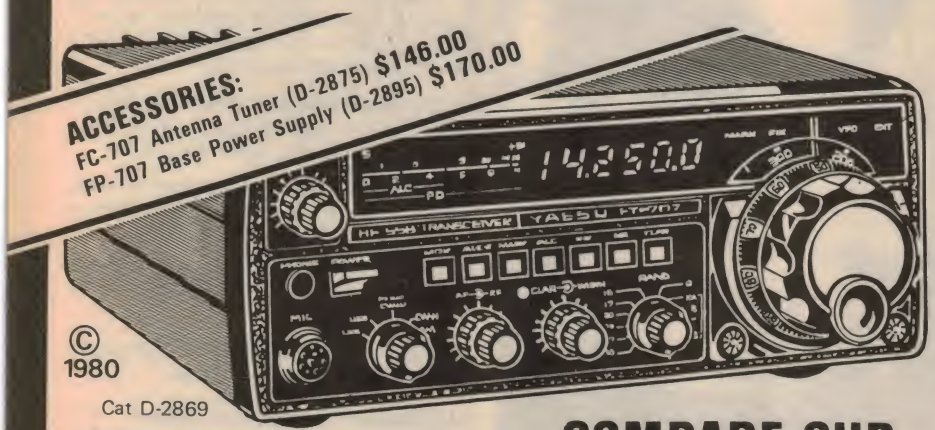
WOULD YOU BUY A TRANSCEIVER THAT IS ALREADY OBSOLETE?



Let's face it: a modern transceiver is quite an investment. Are you prepared to buy a transceiver which would let you down in years to come?
The new Yaesu FT-707 HF transceiver is, as far as we know, the only transceiver on the market with the new HF amateur bands already included. Its modern circuitry represents the 'state-of-the-art' in communications technology. And the really good news: the FT-707 actually costs LESS than many of the superseded transceivers it is replacing. Shouldn't your next transceiver be a Yaesu FT-707?



ACCESSORIES:
FC-707 Antenna Tuner (D-2875) $146.00
FP-707 Base Power Supply (D-2895) $170.00

Cat D-2869

FREIGHT: $6.00 ANYWHERE in Australia (that's below cost!)

'PLANNING AHEAD' was Amateur Radio Action's introduction (review in June issue).

Here's some more of what they said:

'. . . physically very attractive . . . one of the finest velvet smooth tuning arrangements on any transceiver in the world . . . VFO stability is superb . . . receiver performance is excellent . . . sensitivity is very good . . . audio output is clean . . . performance (of the noise blanker rated 'great' on the FT101Z) if anything is better . . . the transceiver is well laid out and simple to operate . . . makes an ideal mobile rig . . . expected to retail for around $850 and therefore on present standards represents good value . . .'

One minor discrepancy: our price for the FT-707 is **over $100 less** than the price quoted above. This must mean it is far and away the best value transceiver on the market in Australia!!!

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You can legally use this transceiver on the Novice bands – then when you get your full ticket, it's ready for you! Why buy a 'Novice Only' rig now and be disappointed later???

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AMATEUR RADIO

by Pierce Healy, VK2APQ

Royal Naval Amateur Radio Society has official blessing of British Admiralty

It is not unusual for amateurs with a common background of employment or other interests to form special groups within the amateur fraternity. One of the most active of these is Royal Naval Amateur Radio Society which, while it started in Great Britain, has now spread through the Commonwealth countries, and beyond.

The Royal Naval Amateur Radio Society was formed in 1960 by radio amateurs who were serving members of the Royal Navy. Many were Chief Petty Officer Telegraphists and the first meeting took place at HMS Mercury, the RN signal school near Portsmouth, England.

In order that the society could be established as a "Naval" society their lordships at the Admirality stipulated that all members and former members of the Royal Navy should be eligible, even though they were not in or from the communications branch.

Hence membership was open to all former and serving members of the RN who had an interest in amateur radio or listening to shortwave broadcasts. Members of the Royal Marines, Women's Royal Naval Service, Royal Fleet Auxillaries, Royal Naval Wireless Auxillary, Royal Naval Volunteer Reserve and Royal Naval Reserve were also eligible.

Later on, members of the British merchant navy, as well as civilians who had been employed by the navy, such as civilian instructors and naval dockyard personnel, were admitted as associate members.

Until the late 1960's it was solely a British organisation. Then a decision was made to admit members of the Commonwealth and merchant navies. A further broadening took place in the early 1970's when all western bloc navies were encouraged to join. Membership classifications were revised, British and Commonwealth members were classified as corporate members and all other nationalities as associate members. At no time was there any different treatment shown to licensed amateurs and shortwave listeners.

Growth in Australia was slow. However, in December 1978, Australian members arranged to hold a net every Monday night on 3613kHz to keep in touch with each other. As the result of publicity in amateur radio and naval magazines, membership in April 1980 has grown to 114, with more applications being processed.

RNARS has approximately 1000 members, the largest group outside the UK being Australia, followed by USA – 65, Europe – 38, Canada – 28, New Zealand – 23, South Africa –16. Members are also located in Japan, Hong Kong, Solomon Islands, Ocean Island and Falkland Islands.

In October 1979, because of the growing membership in Australia, the Australian branch was formed. This exists within the world-wide society, but does give a form of national feeling for members "down-under".

The world wide society publishes a quarterly newsletter and the Australian branch publishes its own newsletter "Australian Signal". The editor is Mike Thorne, VK2BKK, and it deals solely with branch activities within Australia.

When the cruiser HMS Belfast was presented to the British nation for use as a naval museum the Belfast Trust was approached and the RNARS was given the bridge wireless office and has restored the naval equipment and established a permanent exhibition amateur radio station, the call sign being G4HMS.

Recently the British Home Office allocated three special call signs for use on special occasions. The HMS Belfast uses GB2RN whenever the ship is open to the public. The headquarters station G3BZU at HMS Mercury uses GB3RN on open days at Portsmouth Naval Dockyard. The third, GB2FAA has been allocated to the RNARS station at Yeovill Naval Air Station.

Because of the experience of the RNARS in the restoration of the bridge wireless office of HMS Belfast, the Maritime Trust of Australia gladly accepted the offer of the Australian Branch RNARS to carry out a similar project on the HMAS Castlemaine.

On Friday, February 1, 1980, a meeting of Victorian members was held on the ship and a committee known as the RNARS HMAS Castlemaine Group was formed under the chairmanship of Mike Thorne, VK3BKK. The project comprises two overlapping tasks. The restoration of the W/T office is being handled by John Powell, VK3CIE and the installation of the amateur radio station by Jeff Fletcher, VK3NLG.

When the Navy handed over the HMS Castlemaine to the Maritime Trust in 1974 all radio equipment had been removed but most of the original equipment has been located and is currently being restored before re-installation. The call sign VK3BZU originally issued to the HMAS Castlemaine amateur station has been replaced by VK3RAN as a permanent call sign which, although in the repeater "R" series, is not in that category. Regular schedules are kept between the two ships HMAS Castlemaine and HMS Belfast.

VK3RAN will be operated whenever HMAS Castlemaine is open to the public, which is every weekend, public holidays, and Navy Days. RNARS members will be in attendance to explain naval communications and various items of equipment in the W/T office.

In the future HMAS Diamantina will be going to Brisbane to be operated as a naval museum by the Queensland Maritime Museum Association. RNARS members will be restoring and operating from the W/T office of the HMAS Diamantina, hopefully under VK4RAN.

For further information on the RNARS

AMATEUR RADIO

activities write to Terry Clark, VK2ALG, Australian Branch Manager RNARS, PO Box 537, Albury, NSW 2640, or to RNARS Headquarters, HMS Mercury, Leydene, Portsmouth, England UK.

The Australian Branch nets are on Mondays at 1030GMT on 3613kHz SSB and on Tuesdays at 1030GMT on 3527kHz CW.

WIRELESS INSTITUTE COUNCIL BALLOT RESULTS

The ballot for election of the NSW Division Council for 1980-81 was conducted at the adjourned annual general meeting at Wireless Institute Centre, 14 Atchison Street, Crows Nest on Sunday May 18, 1980. In alphabetical order, the following members were elected:- S. Brown VK2BSB; H. Lundell VK2ZHE; T. Mills VK2ZTM; S. Pall VK2VHP; D. Thompson VK2BDT; A. Tilley VK2BAD; E. Van de Weyer VK2ZUR.

At the initial meeting of the council the following officers were elected: President – A. Tiley VK2BAD; Secretary – S. Brown VK2BSB; Treasurer – D. Thompson VK2BDT.

AMSAT-OSCAR launch vehicle fails on take-off

After years of planning and work by dedicated amateurs in several countries, the first of the AMSAT-OSCAR Phase III amateur communication satellites was launched aboard a European Space Agency vehicle "ARIANE" at 1429UTC on May 23, 1980.

Unfortunately, immediately after launching from Kourou, French Guiana, South America, one of the four rocket engines of the space vehicle suffered reduced thrust. One minute after launch the guidance system could no longer compensate for the vehicle's tendency to veer off course and the vehicle entered a wild tumbling spin.

Two minutes after launch ground control began losing telemetry and the range safety officer destroyed the vehicle and with it the A-O Phase III satellite.

Throughout the project the AMSAT organisation met all schedules on time and the spacecraft worked flawlessly until the mission was terminated. AMSAT has proved again that radio amateurs are capable of working in state-of-the-art space technology. The Phase III satellite was in no way responsible for the failure.

AMSAT reported – "What was lost was hardware and, although that obviously hurt deeply, the design and development skills and knowledge, the system software, and the many hardworking

volunteers, remain as resources for the future".

This would have been the 11th amateur satellite (OSCAR I flew in 1961); a proud record for the amateur service.

National amateur radio societies have congratulated AMSAT on their performance and extend their sympathies on the unfortunate loss of the newest member of the amateur satellite family.

(Acknowledgement to W1AW ARRL news broadcast which was repeated on ANARTS RTTY and WIA news broadcasts).

The A - O Phase III project had several facets. On May 5, 1978, the National Aeronautical Space Administration (NASA) and Radio Amateur Satellite Corporation (AMSAT) signed a contract to jointly pursue a project that would allow AMSAT to demonstrate to the public how amateurs build spacecraft (specificially Phase III). Under the terms of the contract, AMSAT and NASA jointly funded a facility at the Goddard Space Flight Center, to be used by AMSAT to construct the Phase III satellites. In return AMSAT demonstrated to NASA visitors the amateur approach to low-cost aerospace construction.

The concept of the Phase III series dates back to 1975, when a tentative program schedule was drawn up. Preliminary design reviews were made in mid-1976.

In 1977 the hardware cost for a Phase III satellite was estimated in the order of $US200,000. Individual items such as apogee rocket motor $US10,000, onboard microcomputer $US8000, and transponder $US5000, were listed in the estimates.

While the final cost of the ill-fated satellite is not known, it was met by subscriptions from AMSAT members in the amateur service throughout the world, together with substantial donations of components from commercial and space research organisations. It was estimated that a government or commercial satellite providing similar performance would cost about $US10 million.

The materials, components, construction and systems incorporated in the amateur satellite were subjected to, and passed, all the stringent tests and requirements applying to government or commercial satellites.

By mid 1978 plans were being made for a complex of ground control stations, completed in March 1979.

Another facet was the preparation of orbital data and the formulation of a users' band plan for the transponder on board the satellite.

It would not be possible to readily assess the total man hours spent by those amateurs who have given time and effort to the project, additional to the work carried out by the two or three technicians employed by AMSAT.

What insurance, if any, was taken out to cover the cost of the spacecraft has not been stated.

However, it is known that several major components and systems were duplicated during the design and building of the flight unit. It is, therefore, reasonable to assume that AMSAT took into consideration contingency factors, such as last minute problems, that would require immediate replacement of units and that any redundant or backup units could be used in a second, but now a replacement launch.

Just when a second Phase III spacecraft can be launched is somewhat outside the planning scope of AMSAT, and depends on a space agency providing a place aboard a suitable launch vehicle.

Some of the features of the satellite make interesting reading, and illustrate the work that went into the design and construction as well as an insight into its use. It was intended not only as an amateur communication medium, but as a free access unit to provide educational and emergency communication facilities on a truly international scale.

Whereas the previous OSCARS used near polar orbits, at low level, the new orbit was to be roughly midway between a polar orbit and an equatorial orbit, more precisely at 57 degrees inclination. It was also to be an elliptical orbit, of about 11 hours duration, with an apogee of about 36,000km above the northern hemisphere, and a perigee of 1500km.

Such an orbit would have meant that any station in the northern hemisphere would have been able to communicate with any other station in the northern hemisphere, for up to 15 hours a day, and with stations in parts of the southern hemisphere for much of the same time.

It is to be hoped that if, and when, AMSAT can build another satellite, that it will have the opportunity to put it into a similar orbit.

WICEN NEWS

The NSW Wireless Institute Civil Emergency Network Committee will commence a training session on Tuesday, July 1, 1980, at Wireless Institute Centre, 14 Atchison Street, Crows Nest. The sessions will commence at 7.00pm each Tuesday evening for six to eight weeks, will last for approximately two hours, and will concentrate in the initial stage on message handling and procedure. Interested amateurs are invited to telephone David Mackie on (02) 269 1616.

On Sunday July 13, 1980, members of WICEN in the southern area of Sydney will be assisting the State Emergency Service in providing point to point communication links during the Sutherland to Surf race. The SES will be responsible for assisting the poiice in traffic control during the event.

During the City to Surf race in Sydney, NSW (Hyde Park to Bondi Beach) on Sunday August 10, WICEN will provide the official communication facility for the organisers. The exercise will handle coordination links, progress information, and emergency aid traffic during the race. VHF and HF links will be used and amateurs wishing to participate are invited to contact WICEN co-ordinator Mike Richter, VK2BMM, on telephone (02) 233 5330 (business), or AH (02) 476 3861.

From Friday October 17 to Tuesday October 21, 1980, WICEN have undertaken to provide communications for the Southern Cross car rally in the Port Macquarie area on the north coast of NSW. VHF and HF links will be established and amateurs wishing to take part should contact WICEN organisers as soon as possible.

RADIO CLUB NEWS

BRISBANE VHF GROUP: Amateurs with a special interest in the world above 50MHz is how the members describe the group. Meetings are held on the fourth Wednesday of each month at the Newmarket High School. A welcome is extended to new members and visitors.

The group owns and maintains the two-metre channel 7000 repeater VK4RBN, the 70cm repeater in Brisbane, the two-metre beacon VK4RTT at Mt Mowbullan, and the 70cm beacon VK4RBB in Brisbane.

Members have combined their knowledge and technical expertise to develop various projects such as VHF-UHF aerials, RF amplifiers etc, and have information available of other projects for clubs and individuals.

All membership enquiries for the group or its activities should be addressed to the – Secretary, Brisbane VHF Group, PO Box 911, Fortitude Valley, Brisbane, Qld 4006.

Radio clubs and other organisations, as well a individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown.

The Australian CB SCENE

SUBMISSION TO THE MINISTER BY THE NCRA

The Federal Government is to review the frequency arrangements and regulations governing the Citizens Band Radio Service. In announcing this recently, the Minister for Post and Telecommunications, Mr Tony Staley, called for submissions from all sectors of the community.

by JAN CHRISTENSEN

Mr Staley rang the National Director of the NCRA (Terry Watkin) and myself (I am still the National Liaison Officer) before he made the release, and advised us of its contents. We spoke with him at length and, during the discussion, he mentioned that he was coming to Brisbane and asked if the members of the National Executive here in Brisbane would be available for talks. There was no question as to what the answer would be!

The NCRA held a National Executive meeting here in Brisbane on the weekend of March 1 and 2 last, so that we cold draw up the NCRA submission in response to the Minister's request. Copies will by now have been circulated around the State Divisions for comment.

The main points of the submission are:

(1) Retention of the 27MHz band.
(2) Expansion of the 27MHz band to an immediate 40 channels with another 40 to follow as soon as possible.
(3) Expansion of the UHF band to include a further 40 channels.
(4) Point of sale licencing for all transceivers.
(5) Licence itself to be free, but a registration fee of $5.00 be placed on each set put on the licence.
(6) Licence renewals to be made at post offices as well as radio branches.
(7) Multi-year licences.
(8) Permission for gain and directional antennas on a non-interference basis.
(9) Emergency frequencies to be placed in RB14 then into Wireless Telegraphy Act.
(10) Overseas communications with reciprocal agreements.
(11) Business communications to be prohibited from the CBRS.
(12) Introduction of a separate General Business Radio Service (GBRS) on UHF.

There were other minor submissions. We keep trying!

CB MAILBAG

I have had some outstanding letters which I would like to tell you about.

One was from Malcolm Lowe, the Central-Northern Regional Director of the Queensland section of CREST Australia Inc. From his home in Mackay, Malcolm writes of the tremendous assistance which CREST was able to give to the SES during cyclone "Amy" in Western Australia. Mackay CREST worked as a link between SES Control and its personnel in the field during "Amy" and subsequent cyclones, and also relayed messages via both the telephone and CB to and from relatives. The Australian Broadcasting Commission was also in there pitching by advising CB operators in the stricken areas that Mackay CREST was getting into the area. The Tropical Cyclone Warning Centre in Brisbane also made use of Mackay CREST by giving them all the updated information that came in so that CREST could retransmit the information into WA.

The marvels of "skip"! A special bouquet to Mackay CREST for a job well done. It takes a special kind of person to monitor the emergency channels. They have to put up with quite a lot . . . interference (both natural and manmade), idiots, and at times apalling operating conditions.

Now how about the other Regions of CREST? What have you been up to? And the other Emergency Monitoring Groups?

★ ★ ★

Another letter comes from Max Morris, President of the Victorian UHF Club. It was like a breath of fresh air to hear from UHF organisation. There are too few of them. Max tells us that the club is extremely active and has members in most parts of Australia, including many who are amateur and/or commercial operators. They have a repeater going in Melbourne, which is working very well. Max sent me a copy of the club's fine newsletter which is used to keep in touch with the members in the rural areas and interstate. On top of this, the club also puts out a newstape.

Max is receiving no news whatsoever from the UHF operators in WA and suggest that you can swap tapes on a "round robin" basis. He would be delighted to hear from you. The address is: The Victorian UHF Club, PO Box 160, Sorrento, Victoria, 3043.

★ ★ ★

Now on to a curly matter. Mr Don McMillan of Cairns has written to me regarding an article of mine "27MHz . . . Who Else Really Needs The Band?" (EA April 1980).

Apparently Don is an avid aeromodeller and is upset that CB was introduced onto the 27MHz band, causing problems for model aircraft. I know people who had the same problem with model cars!

Now Don, I can sympathise with you . . . up to a point. However, if we are to face the facts, it must be realised that 27MHz was never an exclusive allocation for model control. It was and still is the industrial, scientific and medical "dumping ground".

I have had talks with the Brisbane Radio Branch and a manufacturer, distributor and retailer of model aircraft. I also obtained a copy of the RB 195, entitled "Conditions Governing the Use of Radio Apparatus for the Control of Models".

RB 195 tells us that an operator of such equipment can use 26.957 - 27.282MHz, 29.72 - 30.00MHz and 40.66 - 40.70MHz, so I really can't see that you have that

much to complain about, Don. The manufacturer that I spoke to said "Any aero-modeller who uses the frequencies around the CB band was asking for trouble". RB 195 also reads as follows: "Permits may be granted to persons over the age of 16 years to cover the use of approved types of radio apparatus for the control of models". I seriously wonder how many modellers are aware that they need these permits. Are all modellers in possession of them? I doubt it.

Since legislation, CB operators have paid in excess of $6,000,000 in licence fees alone, not to mention import and sales taxes.

★ ★ ★

Thanks must surely go to the Long Distance Transport Association of Aust who wrote to me after reading one of my early articles and offered to circulate my views via their news-sheet. I can only say "Thanks, fellas".

How about other trucking organisations getting in touch with me and letting us all know what you are doing? I'm sure readers would be interested.

WHEN IS CB NOT CB?

- When it is used on other than the official CBRS channels;
- When it is, in fact, a 27MHz marine transceiver
- When it is a Kenwood or other tranceiver intended for the amateur bands.

Let's emphasise the fact again that operators not conforming to CBRS regs. are pirates ... not CBers! Journalists, please note.

The response to my articles has given me a feeling which I can't quite put into words. When first approached about writing this column I was hesitant, mainly because I wasn't sure how a woman's point of view would be accepted. You could say that I took it on as a challenge, and I am pleased to say that it has turned out to be the correct decision. To those who have written to me, "Thank you, and please keep those letters coming in."

The CB scene, in general, is once again on the upgrade and "old time" operators are once more being heard around the channels. For the DXers, the skip is phenomenal at the moment. Though I don't DX myself, I say "Hello" to someone in just about every State each day and always get a greeting in reply. This is great, and I also get a lot of enjoyment out of "sandbagging" on some of the long distance conversations. People are once again starting to use CB as it was intended for, after all, communication is the name of the game. Keep it up.

If anyone would like to write to me about any subject that may be of interest to readers, my address is: PO Box 406, Fortitude Valley, Queensland, 4006. I'll look forward to hearing from you.

Jan Christensen.

SHORTWAVE SCENE

by Arthur Cushen, MBE

Bhutan — a small country, an even smaller radio service

Bhutan, a tiny country in the Himalayas, is transmitting on 4690kHz using only 300W. Reception is reported by readers in Australia and New Zealand when conditions are favourable.

Broadcasts from Bhutan have been received on 4690kHz. Bhutan is a small state in the east of the Himalayas bordering Tibet and broadcasting was commenced on November 11, 1973 by a group of young people who were members of the National Youth Association of Bhutan. The station started with one tape recorder and a mixer made in a biscuit tin. The equipment had to be used inside a tin trunk to shield it from the transmitter.

Since then the station has progressed to using two cassette players with a mixer and the original equipment is kept as a museum piece. The staff are mostly amateurs and volunteers and the station broadcasts news of international and local interest, listeners' choice of music, announcements by various government departments and messages on health etc.

The broadcasting schedule is Sunday 0600-0900GMT on 7040kHz and Wednesday and Friday on 4690kHz at 1100-1400GMT. Bhutan time is six hours ahead of GMT.

The programs are in Dzongkha, which is the national language, Nepali for the Southern Bhutanese, and in English. The English section is the last 30 minutes of each broadcast. The transmitter power is 300W with an inverted V dipole aerial and, as is to be expected, the signals are difficult to receive in Australia and New Zealand. However, reception has been possible and the station has verified those who have heard the broadcasts with an interesting letter from the Secretary, Miss Louise Dorji of Radio NYAB (Broadcasting System of the National Youth Association of Bhutan). The station address is PO Box 1, Thimphu, Bhutan.

NEW BBC TRANSMITTING SITE

The BBC has announced that a new transmitting site is to be built in southern England to house eight 500kW transmitters, the first high powered units to be installed by the BBC in the United Kingdom. The first BBC shortwave broadcasts were on a transmitter rented from Marconi, on November 11, 1927. The station used the call sign G5SW and power was limited to less than 20kW.

Since then there has been a rapid expansion in shortwave broadcasting, firstly at Daventry and later at Crowborough, Rampishar, Skelton and Wooferton. All of these sites are located in the north of England and it was felt that a new location in the south would give a better propogation pattern to some areas of the world.

Four of the new transmitters are being built by Telefunken and four by Marconi. The first is due to come into service in 1983 and the whole station should be completed by 1984. The transmitters will replace some which were put into service in the late 1940s at Skelton and are at present used by the BBC for its world services. These have an output of just 70kW.

NEW STATION IN COSTA RICA

A new signal from Costa Rica has been heard on 6075kHz where Radio Rumbo has been observed around 0800GMT. The station was scheduled to commence operation this year on 6175kHz with 1kW but has instead begun broadcasting on this new channel. The call sign TI CAL has been allocated to the station and reception has been possible from as early as 0600 to past 1100GMT.

According to announcements in Spanish, the station operates on 525kHz in the medium wave band and also on FM. Radio Rumbo is located in Cartago and broadcasts on all three frequencies 24 hours a day. The mailing address is Apartado 140, Cartago, Costa Rica.

KTWR DX PROGRAM

A new program from Trans World Radio station KTWR, Guam, called "DX Listeners Log", is now broadcast each week in three transmissions. The service for Australian listeners is every Friday at 0915GMT on 1184kHz. The other two broadcasts can be heard on Thursday at 0100GMT on 17855kHz and Fridays at 1445GMT on 15365kHz. A special verification card is being issued to celebrate the new DX session.

The program is packed full of information for DXers, including interval signal identification, technical information, propagation data, DX tips and more.

The only other English transmission in the extensive schedule of KTWR is 1430-1500GMT Wednesday-Thursday on 11880kHz.

Two transmitters are used by Trans World Radio, each of 100kW. The address for reception reports is KTWR, Box CC, Agana, Guam 96910.

VATICAN'S INCREASED MAIL

The increasing mail received by Radio Vatican has resulted in a new transmission to China from which mail is now being received after many years. Mail from other quarters also increased to over 50,000 letters last year and, according to the BBC Monitoring Service, it is expected that some 70,000 letters will be received this year. This increase will come mainly from Eastern Europe and China. According to the head of Vatican Radio, some 30-40 letters each month are being received from China, although none were received while Mao Tse Tung was in power.

Vatican Radio has adjusted its frequency to Australia for the daily English broadcast 2210-2225GMT and is now on 9615, 11830 and 15120kHz. Recently two other frequencies, 7235 and 9625kHz, were used on an irregular basis.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WAST, 10 hours for EAST and 12 hours for NZT.

SHORTWAVE SCENE

THREE TIFC FREQUENCIES

Station TIFC, using the slogan "The Lighthouse of the Caribbean", has been heard on three frequencies, opening at 1130GMT. Best reception is on 5055kHz, while 6175 and 9645kHz are also received at fair strength. The opening announcement is in Spanish with details of the frequencies and the address in San Jose, Costa Rica.

Our first verification from TIFC was in October, 1949 when they used 9645kHz for their gospel broadcasts. Transmitter power was 200-350W. Later, in 1954, the frequency of 6037kHz was used. The power has since been increased on all frequencies with 5055kHz now being 5kW, 6175kHz 2.5kW and 9645kHz 1kW. The address is Radio TIFC, Apartado 2710, San Jose, Costa Rica.

BROADCASTS FROM OSLO

Radio Norway has made several frequency changes to its transmissions to the Pacific area and also to other services which provide good reception in Australia. The first broadcast at 0700-0830GMT is now on 9590, 15135 and 21655kHz. The broadcast at 1100-1230GMT is transmitted on 15135 and 21730kHz.

Two transmissions for afternoon reception are broadcast as follows: at 0300-0430GMT on 11860, 11895 and 21730kHz; and at 0500-0630GMT on 11860, 15170 and 21655kHz. English is broadcast for the last 30 minutes of the two Sunday transmissions at 0400 and 0600GMT

BUDAPEST'S SCHEDULE CHANGE

When Summer Time was introduced into Europe in April many stations adjusted their shortwave programs to remain on GMT so that there would be no disruption to the program time for listeners outside Europe. Radio Budapest did not make this change and broadcasts from Hungary are now received one hour earlier. The transmission to the South Pacific is at 0930-1030GMT on 9835, 11910, 15220, 17710, 17785 and 21525kHz. The station has also announced plans to use 25645kHz for this transmission on a test basis.

RADIO JAPAN RELAY

Radio Japan is continuing to use the 250kW transmitters at Sines in Portugal to improve their reception in the Middle East and Europe. Two new frequencies have been scheduled for these broadcasts which are now on 15435kHz at 0700-0730GMT and 15180kHz at 2200-2230GMT. Both of these transmissions are a relay of the General Service. The first 15 minutes consists of news and commentary in English, while the balance of the program is in Japanese.

The program is linked from the Tokyo studios of Radio Japan to the transmitting site in Portugal by satellite and, in addition, there is secondary coverage with broadcasts direct from Japan. Radio Japan continues to be heard in Australia with the special transmission to this area at 0930-1030GMT on 11875 and 15235kHz.

VOICE OF KAMPUCHEA

Signals from The Voice of the People of Kampuchea continue to be received on 9695kHz at 1200GMT when a news bulletin in English is presented. Two other frequencies carry this transmission: 1360kHz mediumwave and 11938kHz. At 1215GMT there is a broadcast in French and at 1230GMT a program in Thai.

These transmissions come from the studios in Phnom-Penh and due to the difficulty of mail service in Kampuchea few verifications have been received. The "NZ DX Times" reports that a letter in English has been received by Dene Lynneberg of Wellington which confirmed his report after nine months. The reply was sent via Hanoi and had no postage stamps attached when received.

FUTURE OF MONTE CARLO

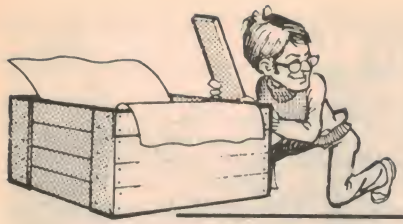
The future of Radio Monte Carlo, one of Europe's best known commercial radio stations, seems to be in doubt according to information published in the BBC Monitoring Service Bulletin. The National Assembly Deputy for Paris is proposing that the Radio Monte Carlo transmitter be handed over to Telediffusion de France and has drafted a bill to this effect. Radio Monte Carlo has been broadcasting since 1945 from a site on French territory and the State owns 83% of the station's capital.

Radio Monte Carlo is often heard on its mediumwave frequency of 1467kHz around dawn and, as it has an output of 400kW, reception in the South Pacific is best around March and September. Monte Carlo is also the site of Trans World Radio which uses the mediumwave transmitter and also many shortwave transmitters for its gospel programs.

"VOICES"

Following the success of Glen Hauser's Review of International Broadcasting, which looks at the program content of shortwave transmissions and is not concerned with reception details, Patrick Humphreys, formerly of Radio Finland, has announced a similar publication based on the programs of stations in Europe. This new magazine, "Voices", is a monthly publication with over 50 pages reviewing and commenting on shortwave radio, including a unique Feature Program Guide, previewing special programs scheduled for the month ahead.

To introduce the magazine a free copy is available to readers by writing to "Voices", Box 226, Helsinki 17, Finland.



NEW PRODUCTS

A CB transceiver for NZ standards

If a New Zealand citizen happens to be visiting Australia and happens to want a CB transceiver for use in his own country, he can buy one in an Australian Dick Smith store and — according to Dick Smith — save a fistful of dollars in the process.

The transceiver being offered is of the well known Midland brand and is identified as type 77A-882NZ; it appears in the Dick Smith catalog as Cat No. D-1435 and carries an NZ Post Office type approval sticker.

The 77A-882NZ has the usual black panel and chrome plated controls, with removeable black, wrinkle-finished half-lids giving access to the PC board and wiring. In fact, access appears to be excellent, although the PC board is tightly packed with diminutive components — typical of recent model transceivers. Dimensions are quoted as 162(w) x 200(d) x 57(h)mm, and weight as 1730 grams.

No copy of the circuit was available but we understand that it uses a phase-locked loop system, which has been set up to cover the 11 channels available to New Zealand CBers. These lie between 26.425MHz and 26.675MHz and are therefore below the Australian channels, in terms of frequency. The transceiver can be modified to include channels 12, 13 and 14, should these become available to the buyer. Frequency tolerance is quoted as plus and minus .005%.

The receiver is a dual conversion superhet, with intermediate frequencies of 10.695MHz and 455kHz.

Controls on the front panel include a 14-position switch (stopped at position 11) and a delta-tune switch allowing the receiver only to be offset by plus and minus 1kHz. There is a continuously variable squelch control, a volume and off/on switch, and an antenna warning indicator which is not mentioned in the instruction sheet. Along the top of the panel is a signal strength and output meter, a noise blanker switch, an automatic noise limiter switch, and another for external speaker.

On the rear panel is the usual SO239 antenna socket, a power socket with matching 12V power cord and miniature jacks for external and PA speakers. According to the accompanying leaflet, the transceiver can be used in a vehicle with either a positive or negative-earth 12V system.

Rated audio power into an external 8 ohm speaker is "more than 3 watts".

Because of the discrepancy between the NZ and Australian CB channels, we chose not to give the transceiver a full on-air test. However, on listening around, it was evident that not all Australian operators suffered such inhibitions, especially when skip conditions were such as to carry NZ CB signals across the Tasman. In these circumstances the receiver performed well on either strong local or congested "skip" signals, the automatic noise limiter proving particularly effective against local electrical interference.

Operating into a dummy load, the transmitter produced the permitted 2 watts of amplitude-modulated RF, with virtually no change in level across the 11 channels. (The NZ regulations make no provision for SSB CB operation).

In discussing the transceiver with Dick Smith Electronics, they pointed out that demand for the Midland unit had been high and that stocks may be exhausted in fairly short order. However, they can continue to meet demand for a further period with a virtually identical unit, from the same factory, but manufactured originally with the "GE" brand-name. Specifications and price are the same.

On the basis that the unit is to be taken back to New Zealand, the Australian tax-free price is $139.50.

Both the Midland and the GE transceivers are sold with a 90-day warranty. The leaflet which comes with the units contains return freighting instructions in the event that after-sales service is required. For further information contact any Dick Smith outlet or DSE Pty Ltd, PO Box 321, North Ryde 2113, Australia. Phone (02) 888 3200; international 61 2 888 3200. (W.N.W.)

Low noise, ultra low leakage capacitors

Facing a world shortage of tantalum materials, and tantalum capacitors in particular, the Elna Capacitor Co Ltd of Japan have announced a line of electrolytic capacitors notable for their low-leakage, low-noise characteristics. The new type RB-LL capacitors are similar in construction to the existing RB range but they are smaller and with improved sealing to cope with the rigours of machine insertion. Additionally, they have more tightly controlled temperature and frequency characteristics. Ratings range from 0.1uF to 2200uF. For further information: Soanar Electronics Pty Ltd, 30 Lexton Rd, Box Hill 3128. Telephone: (03) 89 0661.

Distribution amplifier for TV & FM

Pictured at right is a TV and FM distribution amplifier designed and manufactured in Australia by Electrocraft Manufacturing Pty Ltd. It is intended for use in blocks of flats or home units, or in large homes, where it is desired to operate a number of receivers from a common antenna system.

The antenna would normally be mounted in a prominent position, with the distribution amplifier nearby; the amplifier boosts incoming signals and feeds them into a coaxial line distribution system at a level sufficient to overcome system losses.

Electrocraft advise that there are eight models in the present range, including medium-gain and high-gain models for use respectively in average areas and weak signal areas. They have models for areas such as Newcastle and Wollongong (NSW) where local channels 3, 4, 5A require less amplification than Sydney channels 2, 7, 9, 10. Still other models have in-built gain controls to cope better with local requirements. The manufacturers envisage that their range may need to be expanded to meet other regional requirements.

The distribution amplifiers are designed to attenuate signals below about 45MHz, including a variety of amateur, CB and other HF stations. However, except for deliberate discrimination in certain models, all signals above the low end cut-off frequency are amplified uniformly, right through to the topmost UHF TV channels.

A leaflet with the model 27/100 as pictured, indicates gain figures for the various types ranging from 16dB to 42dB, noise figures generally around 6dB, a response flat to within 1 or 1.6dB, and commendable performance in respect to input and output levels, back attenuation, etc.

The distribution amplifier is housed in a steel case, with black vinyl lid, and measures 23 x 14 x 8cm. It is clearly intended for mounting in a position sheltered from the weather. It operates from the 240VAC power mains and is left permanently switched on. Current drain is not quoted but, to judge by the size of the power transformer, it would be negligible.

For further details, contact Electrocraft Manufacturing Pty Ltd, at 68 Whiting St, Artarmon, NSW 2064. Tel (02) 438 3266.

Wide range of LED assemblies

C & K of Australia, in association with Sloan AG of Switzerland, now offer an extended range of LED indicator lamp assemblies. The range covers 24 different types of LED in three colours, and in-built current-limiting resistors are available as an option. Three mounting configurations can be provided: PC mounting, panel mounting with a rear fixing nut, and panel mounting with a front fixing nut.

The entire range has been designed to match the appearance of C & K switches, providing a uniform panel presentation.

Additional information from C & K Electronics (Aust) Pty Ltd, Office 2, 6 McFarlane Street, Merrylands, 2160.

1000-metre fibre-optic transmitter

New HFBR-1002 fibre-optic digital transmitter from HP makes 1km data links possible.

A fibre-optic transmitter which can transmit data over 1km with guaranteed performance specifications has been introduced by Hewlett-Packard. To complement the new transmitter, HP is also making available its fibre-optic cable/connector assemblies in user-specified lengths.

A bipolar integrated circuit and a new, high-efficiency GaAs infrared emitter convert TTL-level inputs to optical pulses at data rates up to 10 million baud. The new HFBR-1002 transmitter is pin-compatible with the HP HFBR-1001 100-metre fibre-optic transmitter, which means that it can directly replace the HFBR-1001 in existing systems to extend transmission capability to 1km.

Hewlett-Packard's HFBR-3000 single-channel fibre-optic cable/connector assemblies are now also available in one metre increments from one to 1000m. Previously, the assemblies were available in fixed lengths from 10 to 100m. Optimum spectral transmission on the 100 micrometre core cable occurs at 820nm – the wavelength of emission from the HFBR-1002 transmitter. At this wavelength, attenuation is typically 7dB/km.

Further information is available from Cema Electronics Pty Ltd, 21 Chandos St, St Leonards, NSW 2065 or 208 Whitehorse Rd, Blackburn, Vic 3130.

New Products

Icom IC-720 HF transceiver

ICOM HAS RELEASED a new HF transceiver which covers the new amateur frequencies assigned by WARC 79 (World Administrative Radio Conference) as well as providing general coverage to 30MHz. In common with other Icom transceivers, the new unit incorporates a microprocessor. Tuning is accomplished by an "optical chopper" VFO which is claimed to give better linearity with no backlash.

Other features include a speech processor, bandpass tuning and an effective noise blanker. A range of options, including an automatically tuned HF mobile antenna, will also shortly be released. Enquiries to Vicom International Pty Ltd, 68 Eastern Rd, South Melbourne, Victoria 3205.

Microwave security system

With shop-lifting accounting for as much as 3% of the turnover of retail stores, more and more shops are using advanced electronic devices to detect thieves. One such device is the newly released Senelco Slimline, a microwave-based system specifically designed for small shops.

The Slimline consists of two waist-high pillars, about 100mm thick and spaced approximately a metre apart on either side of the store exit. On the floor between the pillars is a rubber mat which conceals a wire grid. Each of the pillars contains a low-powered microwave transmitter and receiver, while a 100kHz signal is fed into the grid on the floor.

Special tags which are attached to goods in the store include a sensor which detects and mixes the two signals and reflects the modulated microwave signal back to the receiver when the tag is brought within range of the field. The received microwave signal is filtered and used to trigger either an audible or visible alarm, so that any attempt to remove an item from the store with the tag still attached will be detected.

The tags themselves are available in various forms to suit any type of merchandise, and once attached to the goods can only be removed by a special tool at the sales desk.

Further information can be obtained from Senelco Pty Ltd, 23 Ben Boyd Rd, Neutral Bay, NSW 2089.

High-power switching transistors

A new series of NPN high power bipolar transistors, the HPT540/45 and HPT440/45 series from International Rectifier, are rated at up to 50A continuous collector current and 75A peak collector current. They are available with voltage ratings up to 450V, and are suitable for use in high-power off-line inverters and switching regulators, eliminating the need for paralleling smaller transistors.

The new IR bipolar devices are housed in TO-83 studmount packages of molybdenum to minimise thermal stress. With a maximum thermal impedance of 0.5°C/watt, the HPT545 series can dissipate 300W at 25°C case temperature or 150W at 100°C case temperature, and has a maximum operating and storage temperature range of -65°C to +200°C.

Further details can be obtained from Warburton Franki Pty Ltd, 199 Parramatta Rd, Auburn, NSW 2144.

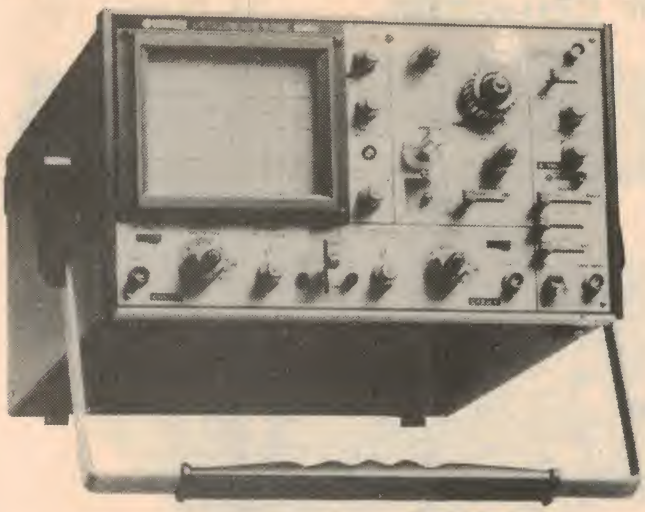
Hand-held printing calculator

National Semiconductor has introduced a compact, 12-digit calculator with an in-built thermal printer. The new calculator, the NS500, is just 30mm thick, 70mm wide and 140mm long, and comes complete with rechargeable batteries, charger, five rolls of paper, and a carrying case.

For more information contact N. S. Electronics, PO Box 89, Bayswater, Vic 3153.

New Products

50MHz dual trace oscilloscope



New Hitachi V550 dual trace oscilloscope features 50MHz bandwidth and delayed sweep.

Standard Components Pty Ltd has announced the release of Hitachi Denshi V550 dual trace oscilloscope.

The V550 features a delayed sweep that allows magnification of any desired portion of the displayed waveform up to 1000 times, while a third trace on the screen displays the trigger (either internal or external), allowing timing comparisons to be made.

Other features of the V550 are the 1mV sensitivity setting, 50MHz bandwidth, and a single sweep facility which allows investigation of momentary events and is essential for explosion, voice or impact experiments. A 15cm square CRT developed by Hitachi gives a brighter than usual display while using acceleration voltages within the normal range.

Standard Components Pty Ltd are located at 10 Hill St, Leichhardt, NSW 2040.

Antenna rotators & tuners

Daiwa Company of Japan has released a new range of antenna rotators which incorporate a map of the world – centred on Australia – to show the bearing of the antenna. Two new control boxes are available for both the heavy and medium duty rotators. With the "pre-set" type of controller the antenna direction is set by turning a knob to the desired bearing, and the rotator then turns to the selected heading. The other type of controller uses the traditional method of pressing a button until the direction pointer indicates the desired bearing.

Also from Daiwa is the CNW418, the first amateur radio antenna tuner designed to incorporate the WARC bands of 10, 18 and 24MHz. The coupler handles 500W PEP and includes the popular direct reading "cross needle" type of SWR/PWR meter. Output impedances of 10-300 ohms can be handled, and input impedance is 50 ohms.

The Daiwa range is distributed in Australia by Vicom International Pty Ltd, 68 Eastern Rd, South Melbourne, Vic 3205, and is available at most amateur radio dealers.

Moulded plastic instrument cases

A range of two-tone brown, moulded ABS plastic instrument cases has recently been released by Vero Electronics.

Available in three heights, the "Hi-Style" range is supplied complete with a carrying handle which doubles as a tilt foot. The angle of tilt is adjustable.

The base section has moulded-in PCB mounting pillars but, apart from these, the inside of the case is clear for maximum space utilisation. The flat front and rear panels are removable for easy machining and are held in position by the assembled case.

For further information contact Warburton Franki, 199 Parramatta Rd, Auburn, NSW 2144.

Smart frequency counters from Philips

Two microprocessor-based frequency counters, the PM 6667 and PM 6668, have been announced by Philips. The use of a microprocessor gives the counters higher resolution and makes them more convenient to use, as well as saving on the cost of traditional components.

The new Philips counters span a frequency range of 10Hz to 120MHz for the PM 6667 and up to 1GHz for the PM 6668. Automatic triggering, 15mV sensitivity and a six-position input attenuator allow fast triggering, ensuring a stable readout on the high-contrast 7-digit liquid crystal display.

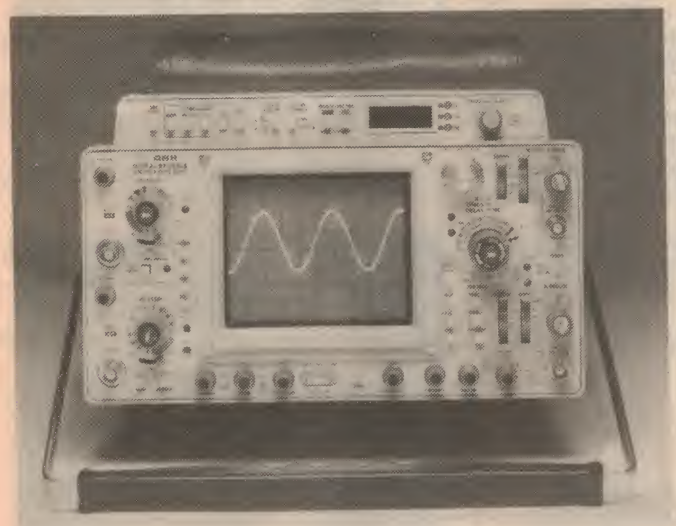
The microprocessor incorporated in the instruments allows a new approach to frequency measurements that eliminates the normal ±1 cycle error. By making a multiple period measurement and computing the reciprocal of the results, the counters provide high resolution frequency measurement of low frequency signals.

Two measuring speeds may be chosen: normal, with 7-digit resolution every second; or fast, with 6-digit resolution in 200ms.

Other benefits from the use of a microprocessor are the elimination of manual range selection (the microprocessor takes care of the display shift and activates the proper Hz, kHz, or MHz indicator and decimal point regardless of the input frequency), and the inclusion of a self-diagnostic test routine.

For further information, contact Philips Scientific and Industrial Equipment, 25 Paul St, North Ryde, NSW 2113.

New digital storage oscilloscope



Tektronix 468 Digital Storage Oscilloscope has capabilities of 465B 100MHz oscilloscope, and uses an 8-bit digitiser to achieve 10MHz storage bandwidth.

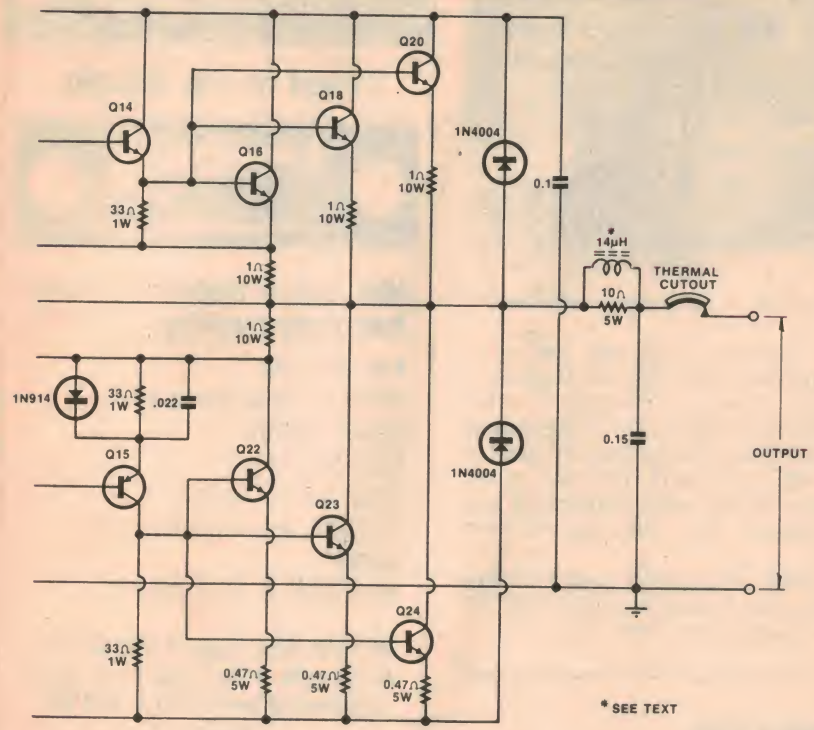
The new Tektronix 468 Digital Storage Oscilloscope increases digital storage bandwidth limits, detects aliased signals, and corrects envelope error and display jitter — problems which have plagued earlier digital storage 'scopes. In the non-storage mode the 468 has all the capabilities of the Tektronix 465B 100MHz oscilloscope, and in the storage mode continues to "drive" like a non-storage oscilloscope. Storage mode is selected by pushing a button, and waveforms are stored as easily as they are viewed in the non-storage mode.

The 468, which will be available in August, uses an 8-bit digitiser and a unique display interpolation technique to achieve a 10MHz "useful storage bandwidth". "Useful storage bandwidth" is defined by Tektronix to mean a usable and accurate representation of a waveform, with less than 5% envelope error. It indicates the maximum frequency sinewave that can be usefully stored in a single sweep.

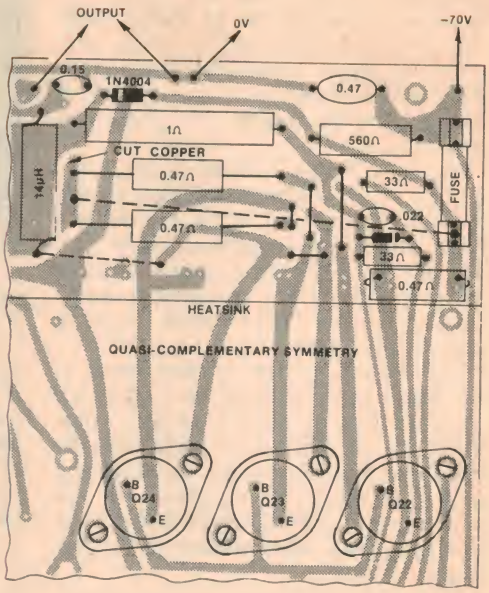
The envelope mode uses dual sampling rates and records maximum and minimum values of a waveform envelope into memory over a selectable number of sweeps (two to 256 plus continuous setting). It can capture narrow pulses on long sweeps and is useful for glitch catching, viewing waveform excursions, and detecting aliasing.

Additional information is available from Tektronix Australia Pty Ltd, 80 Waterloo Rd, North Ryde, NSW 2113.

CORRECTION: Playmaster 300W Amplifier



QUASI-COMPLEMENTARY SYMMETRY



PLAYMASTER 300 (June 1980, 1/MA/55): In the quasi-complementary circuit shown on page 57, the 1 ohm/10W resistors associated with Q22, 23 and 24 do not ensure current sharing. To ensure current sharing in these transistors the circuit should be modified as shown in these diagrams. On the PCB, replace two of the 1 ohm resistors with 0.47 ohm/5W units and replace the two parallel links with a third 0.47 ohm/5W resistor. Delete one 0.1uF capacitor, cut the copper pattern as indicated and re-arrange links as shown. The two links shown dotted are on the underside of the board and should be made with insulated wire.

Note also that the PCB diagram on page 59 of the June 1980 issue should show the supply rails as ±70V, not ±75V.

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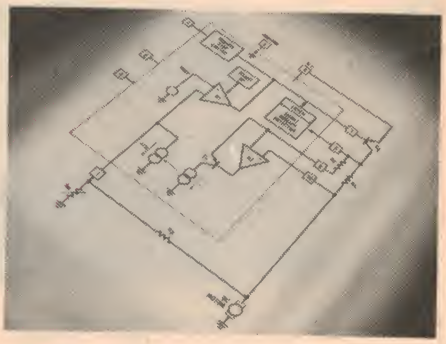

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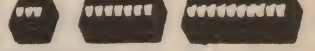

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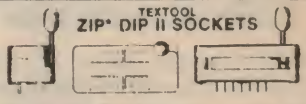

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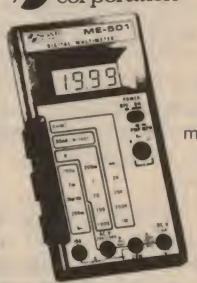

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SCHUMANN Fantasie: "Outstanding recital"

SCHUMANN — Fantasie, Op 17. Fantasiestucke, Op 12. Played by Martha Argerich (piano). CBS Stereo 767913.

What appeals most to me in Ms Argerich's account of the great C Major Fantasia is her impetuosity — a favourite word of mine when writing about Schumann's music. (I except the Piano Concerto.) And I mean the performance as well as the content. In this instance I am aware that a case could be made out against the pianist for a measure of self-indulgence in her reading; her "blowing up" of unimportant details, for instance. But to me this treatment is a combination of youthful enthusiasm and a careful weighing up of contrasts in dynamics and sonorities.

It must be remembered, too, that the composer marked the first movement "fantastic with passion". The significance of that first word should not be forgotten, especially by the more staid exponents of this composer's work.

Specially notable is her alternate assertiveness and tenderness in the chordal passages of the second movement, which again demonstrate her appreciation of the wide contrasts called for in the work. Another point to notice is the way she never allows long passages of dotted notes to become monotonous. And when at last you meet the Finale, the way she caresses the notes is a delight.

The eight short pieces that make up the Fantasiestucke are best known to audiences as encore pieces at piano recitals. Her Chopinesque touch in the first item, Des Abends, is enchanting. I liked less her cavalier treatment of the next, Aufschung, which is somewhat overdone in speed and loudness. But it is note-perfect, despite its close approach to recklessness. In Warum (why?) Ms Argerich's quiet persistence seems to increase her demand for an answer. Then comes the compelling rhythm of Grillen and the restlessness of The Night, which follows.

The next item, Fabel, is one of the masterpieces of the recital. It seems almost "weightless" and its fleetness is close to the incredible. The other outstanding piece in an outstanding recital is Traumes-Wirren, the first part of which passes like a flash; then a few slow bars, as if to give her time to catch her breath for the resumption of the first theme. If a note or two is blurred occasionally, it doesn't seem to matter. To close, after the decisive end of The Song, nothing more remains to be said.

Sound is good average. (J.R.)

TCHAIKOVSKY Piano Concerto: "different . . ."

TCHAIKOVSKY — Piano Concerto No. 2 in G. Philips Stereo Cassette (Sonic Series) 7317 196. With the Monte Carlo National Orchestra conducted by Eliahu Inbal. Soloist: Werner Haas.

Here is another "different" reading from the usual run of interpretations. Here the general tendency is to go hell-for-leather after the virtuoso features of the concerto.

Before his death in a car accident, Haas made complete recordings of all Tchaikovsky's piano concertos but this is the only one I can trace that has been issued. It first saw the light under the Philips label in 1978 and didn't cause much of a stir. In my opinion it deserved better — with one reservation. The Monte Carlo Orchestra sounds far from its best, despite Inbal's manifest effort to improve it. But here I might be unjust, because I listened to it on a cassette and, for all I know, the sound might be better on disc. Certainly, one expects better sound from Philips than one hears here.

Fortunately, the piano tone is quite satisfactory. So is Haas' performance, although it tends to be more lyrical than you might expect. His main concern seems to be to avoid hysterical climaxes that are strewn so temptingly along his path. The key to Haas' attractive lyricism can be found early in his treatment of the second subject of the first movement. And indeed you won't find any harsh thumping anywhere in his performance.

Allied to his other merits is a technique that is always completely assured and that responds effortlessly to any demands he makes on it. By the way, it might be worth noting that Tchaikovsky himself always claimed that the concerto should be played in a lyrical rather than a virtuoso style. At any rate, don't dismiss it on the strength of this review without hearing it first. (J.R.)

★ ★ ★

SCHUBERT — Octet in F, Op.166 D.803. Academy of St Martin-in-the-Fields Chamber Ensemble. Philips de Luxe Stereo Disc 9500 400.

This disc faces formidable competition from the Melos Ensemble's performance issued some 10 years ago. Differences between the two in the matter of playing and interpretation are minimal. The Academy plays the two outer

Reviews in this section are by Julian Russell (J.R.), Paul Frolich (P.F.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

movements slightly faster and the second movement slightly slower. In the movement with variations yours will be choice of which you prefer: the more leisurely gait of the Academy or the Melos' tiny advance in tempo.

In both versions the phrasing and inflections are a continuing delight. But if some persistent reader were to demand that I make a choice between the two I would have to select the new issue (the Academy) soley on the matter of the recording which seems to add a little additional freshness to its older rival. And there is also the immaculate leadership of Iona Boiwn. (J.R.)

★ ★ ★

JANACEK — Sinfonietta with Fanfares. HINDEMITH — Metamorphoses on Themes by Weber. London Symphony Orchestra conducted by Claudio Abbado. World Record Club Stereo Disc R.04247.

Except for some Czech or rather Moravian characteristics, Janacek's music is like no other in the recognised styles of Western music. Despite its complexity and subtlety, it has all the surface innocence of a child's finger painting. Much of his brilliant and highly original orchestral scoring call to mind the vivid colour contrasts of the German expressionist school of painting.

Made up of short repeated ejaculatory phrases, there is little resemblance to Western sonata form; yet everything seems to work out quite naturally as an organic whole. He can be both vulgar and elegant in the space of a bar or two. There is a simple immediacy about his drama that is instantly effective. His energetic music brooks no contradiction. It is as impossible to imagine before it was written as it would be to copy, except in parody.

In this little Symphony with fanfares, he sometimes relents to make small compromises with the West. There is, for instance, a recognisable likeness to Puccini in the beginning and end of the third movement and a deliberately vulgar dance tune in the middle section. The arresting fanfares which announce the work are developed, or rather slightly altered, according to the mood of different parts of the work.

Abbado starts them off almost caressingly, never digging down into the brass to make it bray. Even the slurring phrased trumpet bars don't go through your head from one side to the other. His change of rhythm a few bars on is brilliant when the music changes to an atmosphere of pageantry. The beautifully tender theme of the third movement is coaxed affectionately by Abbado so that, when the brass enter, they do so with enforced contrast. All through, the frequent return to the mood and musical ideas of the first movement (though nearly always differently scored) are always exciting. The conducting, playing and sound are beyond praise throughout the whole five movements and the work's originality is always unique.

Hindemith's usually machine-made music is a bit more unbuttoned than usual in this piece, as if the stiff-shirted composer has undone his collar for a change. But it can never match the simple joyousness of Janacek's. Just what is the difference between a symphonic metamorphosis and a variation perhaps only the composer could explain. Some of the movements have a Hungarian flavour — with a lot of notes added. Others have a kind of beery gemuthlichkeit. There is one that tiresomely repeats such chinoiserie.

The third movement (andantino) has some pleasant twilight sound as if, for once, the composer was using his heart instead of his head. And there is even some evidence of fun when Hindemith sends up a mournful funeral march by Weber. (J.R.)

★ ★ ★

MAHLER — Songs from Des Knaben Wunderhorn sung by Jessye Norman (soprano) and John Shirley-Qurk (bass) with the Concertgebouw Orchestra conducted by Bernard Haitink. Philips de Luxe Stereo Disc issued for members of the World Record Club 9500 316.

Here is a chance to compare the very great talents of two fine singers, Jessye Norman and Janet Baker, in this suite of lovely songs. Here I prefer ever so slightly Ms baker's "Wo die Schonen Trompeten Blasen" to Ms Norman's, although both performances are of quite extraordinary beauty, each fully realising the drama and sorrow of the song. Don't be put off the present disc under review by a tendency to ordinariness in the first stanza of the first song, Der Schildwache Nachlied, sung by Shirley-Quirk for Ms Norman enters gloriously in the second verse. Indeed all through this recital Shirley-Quirk does all the right things for the right reasons but I still found him strangely unmoving. Indeed it is Ms Norman who makes this recital so thrilling to me.

She is in glorious voice throughout, though it is curious, after her light touch in the French recital, to hear her treating somewhat more heavily the lighter items in the Mahler suite. But this is to quibble, because there is so much to admire and enjoy in the whole disc that to choose a detail here and there for pinpricking criticism seems churlish. And I still haven't mentioned another great contributor to this splendid issue — Bernard Haitink and the Concertgebouw Orchestra. Haitink is now my favourite Mahler conductor and he and his superb

CLASSIC PREVIEW SET

Four Brahms symphonies

BRAHMS: Symphonies (Nos 1-4, complete). Vienna Philharmonic Orchestra, conducted by Karl Bohm. DGG, box of four stereo discs, with booklet $19.99. From Classics Preview Series, 11 Hargrave Street, East Sydney. (Tel 31 0255).

Although one may assume that all seasoned collectors would own recordings of the Brahams symphonies, as well as representative examples of the V.P.O.'s playing and Bohm's conducting, this set may prove of interest to them as well as, needless to say, young music-lovers who are just starting out to build a collection. The bargain price, even by the standards of Clubs, is certainly a major attraction, but there's more to it than that.

In recent years, a body of criticism has built up around Bohm, accusing him of relentlessly slow tempi and a degree of stodginess; when I witnessed him in action in London, just two years ago, I found no trace of these "blemishes". The Brahms symphonies, recorded by him in 1976 and directing an orchestra whose members will not tolerate much divergence from their time-honoured Brahms tradition, are further proof of Bohm's devotion to what is in the score — neither more or less — and of his ability to overcome all noticeable symptoms of old age. There may be more exciting performances of each of the four symphonies, but not necessarily better ones, nor more faithful to the composer's intentions.

Low-priced as they are, records calling for a laying out of $20 need to be carefully considered. In this instance, I have no misgivings in advising purchase: Brahms' symphonies are an important part of our musical heritage and should be well known to every music-lover; the Vienna Philharmonic remains an orchestra of high quality, producing a unique sound and Bohm personifies one of our last musical links with pre-war Europe. Added to which, the quality of the records produced by DGG is outstanding, the recorded sound excellent and — a point not to be overlooked — this fine set has not been commercially offered in this country. (P.F.)

orchestra are in grand form for this performance. His sense of balance between the composer's wonderful scoring and the voice is never less than beyond praise. And Philips' engineering is another feature added to this disc's many splendours. Although it has some formidable competitors, it can hold its own with the best and surpass many others. And those Mahlerian enthusiasts who are hearing the songs in their entire form for the first time will recognise immediately the origin of so many of the themes Mahler used later in his symphonies. (J.R.)

★ ★ ★

SCHUBERT: Piano Sonata No. 17, D major, D.850; Four German Dances from D.366. Vladimir Ashkenazy, piano. World Record Club stereo disc R 05218.

This is, even now, still one of Schubert's little-heard piano sonatas; currently, the only available versions I am aware of are those played by Brendel and Walter Klien and, for this reason alone we should be grateful to have another competitive reading. Alas, things aren't quite so simple; pianistically, Ashkenazy is at least the equal of Brendel and decidedly superior to Klien, but this does not mean that he is able to give better interpretations of Schubert's music.

Viennese traditions are a peculiar thing and, it seems, not easily absorbed by learning. There has to be a modicum of less than perfect taste, a smidgin of "schmaltz", a certain blurring of strict time and rhythm — almost indescribable details that are hard to explain and do not come easily to outsiders. There have been exceptions: notably Solomon and, closer to home, Tessa Birnie demonstrated what I regard as THE right way to play Schubert. Ashkenazy has not discovered this and may well not wish to do so; he plays superbly well and with exquisite good taste.

What I regard as a failure may well be regarded as a great "plus" by many music-lovers and I cannot but commend this performance to them. As far as the Dances are concerned, rightly described as "Landler", the things that worry me in the sonata are, of course, even more obvious. Leaving Viennese idiosyncrasies out of the discussion, this is a very fine disc, with excellent piano sound, full of lovely music. (P.F.)

★ ★ ★

THE SEQUOIA STRING QUARTET. Quartet in F-Major (Ravel). Quartet number three (Bartok). Stereo, digital master. DELOS DMS-3004. [From P. C. Stereo, PO Box 272, Mount Gravatt, Qld 4122. Phone (07) 343 1612].

Founded in 1972, the Sequoia String Quartet has won wide recognition and is currently Quartet-in-Residence at the California Institute of the Arts. Women members of the group are both Japanese born, and both came to America to further their studies of the violin: Yoko Matsuda and Miwako Watanabe. American James Dunham plays viola and Robert Martin is cellist for the group.

Numerous recordings of the Ravel quartet are — or have been — available but this would appear to be the first to use the digital mastering process. In fact, the jacket notes claim that it is the first-ever digital recording of any string quartet.

Combining this with the individual and collective talents of the Sequoia String Quartet provides almost a guarantee of a most enjoyable recording and this is what it turns out to be. The sound is immediate and intimate, unspoiled by any hint of noise or distortion. And this, of course, holds for the shorter Bartok work, which occupies the latter portion of side two.

Will you enjoy it? If you know and like the works, the answer will be a positive yes. If you don't, Delos do their best to help with generous notes on the Sequoia Quartet, on the composers and on the circumstances surrounding the respective compositions. Another good one from Delos. (W.N.W.)

THE ART OF FUGUE. Johann Sebastian Bach. Arranged by Leonard Isaacs. Members of the Philomusica of London directed by George Malcolm. World Record Club stereo WRC R 05859/60. Two-record set.

This two-record set is the complete collection of fugues and canons written but not completed by Bach shortly before his death. They were intended by Bach to fully demonstrate the range and variety possible within these two forms. Leonard Isaacs has put together a scholarly arrangement of the works which omits the finishing fugue composed by Sir Donald Francis Tovey.

I found the album very satisfying. The playing of the members of the Philomusica of London is of a very high standard which is matched by the recording quality. Recommended (L.D.S.)

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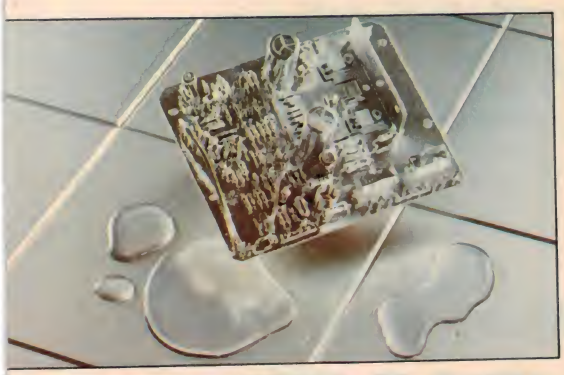

Sansui's AU-X1 is the DC amplifier in which current saturation is impossible. So TIM and envelope distortion are virtually nil. And accurate reproduction of musical signals reaches new levels.

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New devotional albums

B. J. THOMAS, You Gave Me Love. Stereo, Myrrh MSB-6633. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135).

In the jacket notes, well known singer B. J. Thomas tells how he has embraced the Christian faith and of its effect on his life and thinking. The track titles are part of this theme: Using Things and Loving People – Jesus On My Mind – You Gave Me Love – The Faith Of A Little Child – I'm Gonna See Jesus – Lord I'm Just A Baby – I Need To Be Still – Love Has Arrived – He's Walking In My Shoes.

While the backing varies from track to track, B. J. Thomas has plenty of support available from the Nashville scene – around 26 instrumentalists, eight singers and a children's group. There are quieter moments but, by and large, the beat is rock/up tempo and aimed at those most likely to know the B. J. Thomas of other days.

The lyrics are printed in full on the inner sleeve and I noticed that all carry a 1979 copyright endorsement. If the style sounds attractive, you won't have any problem with the sound; it is very clean. (W.N.W.)

★ ★ ★

FOLLOW ME. A LOVE SONG. John and Amanda Yivisaker. Two-LP stereo (Dolby) cassette AVC 111/2. (From Move Records, Box 266, Carlton Sth, Vic 3053).

According to the very brief notes on the folder, these two titles are still available on separate LP discs, but they have been married on this long-playing cassette. Both are scripture-based, with the lyrics being, for the most part, a close adaptation of the Bible text.

"Follow Me" is virtually a survey of the Gospel story: The Birth – Song Of The Stable Boy – John The Baptiser – Nicodemus – Wade In The Water – The Rich Young Ruler . . . etc.

On side two "A Love Song", the subjects are a little more diverse: The Old And The New – Moses – She Didn't Know – The Prophecy – Joseph – The Camel Swallowers – Palm Sunday . . . and so on.

One might assume that 12 Bible songs per side might be a bit much but that does not take into account John and Amanda Yivisaker's skillful choice of style (calypso, rock, soft-shoe, etc) and their accompaniment pattern (six and 12-string guitar, electric guitar, flute, organ, piano, celeste, string bass). The tape could easily qualify for either deliberate listening or for background.

The technical quality is fine. (W.N.W.)

★ ★ ★

MAKE A JOYFUL NOISE. The Fountain Street Church Choir directed by Mr Beverly R. Howerton. Allen Computer Organ played by Donald L. Westfield. Stereo (no brand), DLW-1015. [From Allen Organs, 32 Woodhouse Rd, Doncaster East, Vic 3109. Phone (03) 842 3465].

Recorded in late 1974, this album is still available and still interesting. It was issued, apparently, as a local momento to the opening of the huge Saint Francis de Sales Catholic Church in Muskegon, Michigan, USA. Guest musicians for the occasion included the Fountain Street (liberal Baptist) Church Choir (Grand Rapids, Michigan), with choirmaster and organist. Since Donald Westfield was also connected with the Allen Organ Co, he was a logical person to "open" St Francis de Sales' new Allen electronic organ. It was also logical for the same company subsequently to "adopt" the record for sales promotion.

In the huge auditorium, credited with a seven second reverberation period, the organ sounds quite magnificent, with all the weight and power of a big pipe instrument.

The choir, too, rises to the occasion with a varied program: Make A Joyful Noise (Williams) – Twenty-Third Psalm (Matthews) – Christmas Day (Holst) – Lacrymosa, Requiem (Mozart) – Jubilate Deo (Bales) – Grant Me True Courage Lord; Sinfonia From Cantata 129 (Bach) – Winter Comes (Kimmel) – Now Sleeps The Crimson Petal (Quilter) – Give Me Your Tired, Your Poor (Berlin) – The Lord Bless You And Keep You (Lutkin).

The performance makes good listening in its own right but it carries a bonus if you are interested in the sound of a big electronic organ in the kind of situation normally accorded a large pipe instrument. (W.N.W.)

RECORDS & TAPES — continued

"AND VIENNA DANCES" Music by Lehar, Kalman, Johann Strauss Jr, and Sieczynski. Carole Farley, soprano; The Columbia Symphony; conducted by Andre Kostelanetz. The CBS Stereo disc SBR 235985 & Cassette RC 985.

To accept this disc as a showcase for Viennese music would correspond with equating the Empire State Building and the Vienna State Opera House — grand old buildings both, they have very little else in common. The music as such could be regarded as reasonably representative: items from "The Merry Widow", "Countess Maritza", "Guiditta" and "Fledermaus", plus the "Blue Danube Waltz", the "Tritsch-Tratsch Polka", etc. What is not acceptable is the manner of performance and recording.

To be quite clear on this: the orchestral playing is absolutely first-class, the recorded sound likewise and Miss Farley's singing is, technically at least, all one could wish for. But there is no mistaking the performance as being 100% American; instead of the lilting rubato that Boskovsky, to name an outstanding conductor of Viennese music, can impart to dances and snatches from operettas, we are given the very latest in strict time and brassy polish, solidly amplified and over-bright. I know that performances of this type are tolerated, perhaps even popular, in the USA, but they should not be regarded as being "Viennese".

Miss Farley — who is married to conductor Jose Serebrier, recently admired in Sydney — may be visiting Australia shortly and I regret that this is the only example of her work to come my way up to now. She is obviously a fine singer, but the techniques used in producing this disc do not allow one to arrive at a measured judgement of her voice or musicianship. (P.F.)

★ ★ ★

GENTLE NOVEMBER. Kazunori Takeda, saxophone. Digital mastered stereo, Frasco FS-730. [From M. R. Acoustics, PO Box 165, Annerley, Qld 4103. Phone (07) 48 7598, (07) 284 6764].

Virtually all the information on this album, apart from the titles and credits is printed in Japanese, but we do know that four players are featured on tenor sax, piano, drums and bass. The jacket picture also shows the recording session in progress, with a multi-mic set up and acoustic baffles between the players.

Kazunori Takeda has a super-relaxed style, as if not in the slightest hurry to get through the 40 minutes on this album.

Just here and there, the group breaks into a gentle jazz sound, that confirms their capability as a group.

Just one small credit line in the English titles indicates that this is from a digitally

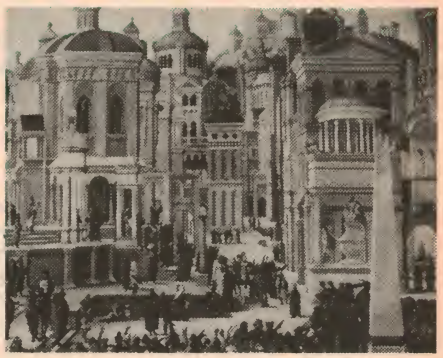
(Continued on page 109)

Digital from M&K RealTime

TCHAIKOVSKY: The Nutcracker Suite; Romeo & Juliet Overture — Fantasy. Zoltan Rozsnyai and the Philharmonia Hungarica. Stereo, digital master. M&K RealTime RT-201. [From M. R. Acoustics, PO Box 165, Annerley, Qld 4103. Phone (07) 48 7598].

A point of note about this album is that it signals a move into digital mastering by M&K RealTime, who have hitherto made their name with direct cuts. They have also moved into dbx processed records, but more of that later. This one is a straight recording done on a Sony PCM digital recorder, with disc processing done by Teldec in Germany.

Expecting top quality, the opening theme of The Nutcracker set me back because of the distinctly formant sound of the brass but there was no hint of it on the strings. I'm still undecided whether it had to do with the acoustics or mic placement, or was simply the effect of half-muting on the brass, as suggested by Paul Frolich.



I mention it so that you'll be prepared. But the fact is that the sound predominantly is clean and open and I haven't the slightest inclination to debate digital V direct. There's no noise to compromise the soft passages and no distortion to mar the loud. Mind you, it's difficult to listen to this music without recalling, once again, the visuals from Walt Disney's "Fantasia".

The "Romeo and Juliet" music is less familiar; you'll enjoy that, too. In any case, there are generous notes on the jacket covering the composer, the music and, of course, the conductor and orchestra.

A good one. (W.N.W.)

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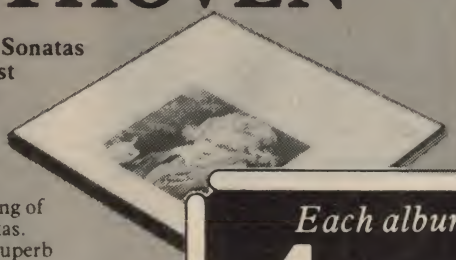

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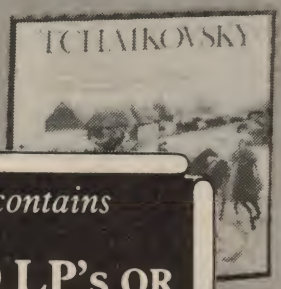

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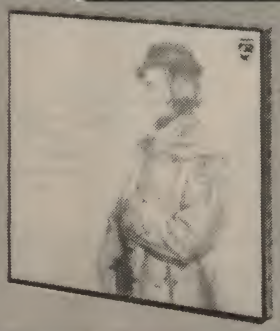

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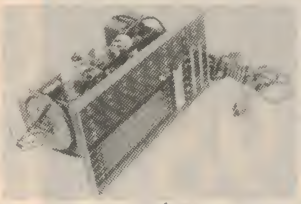

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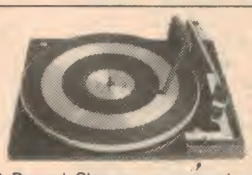

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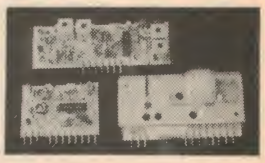

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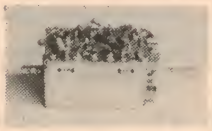
Transistor NT3024, NT3030, NT3032, Colour — P&P $1.



$10 ea.

master — admittedly not a vital consideration with its non-demanding dynamic range. But the sound is certainly very clean as the group plays: Soul Trane — Theme For Ernie — Aisha — It's Easy To Remember. On side two are four compositions by Kadeka: Once I Talked — Our Days — Little Dream — Gentle November.

"Gentle November" is an apt title. (W.N.W.)

★ ★ ★

THE BEST OF THE BEST OF 101 STRINGS. Stereo, Alshire (Astor) S-5373. (Also on cassette).

Despite the double superlative in the title, this new album is best regarded as just one more in the series by the popular 101 Strings Orchestra. They open with the mod sound of "ATaste Of Soul" but, almost immediately, get back into character with "I Left My Heart In San Francisco". The strings are well in evidence for the remainder of the program: Evergreen — Stardust — The Way We Were — Lara's Theme — Nancy's Song — Moon River — Scarborough Fayre — Stranger On The Shore — Raindrops Keep Falling On My Head — Summer of '42 Theme.

The style is typical middle-of-the-road 101 Strings and the sound quality about average. (W.N.W.)

★ ★ ★

EXHIBITION. John Serry. Chrysalis L 36998. Festival release.

This is the debut album for 26-year-old American John Serry. Before going solo he was the keyboardist and spokesperson for the group Auracle, whose 1978 album "Glider" gained international accolade.

The album style can be summarised by John Serry: "The jazz of the last 30 years has greatly influenced me, primarily in the area of playing, of improvising but not especially in my writing. As a composer, I look into the classics of the past 400 years."

The seven tracks on the album are: Care To Dance — Acting Up — Nicole — Sabotage — Exhibition — Just For Kicks — Mouse March.

He composed all seven tracks, orchestrated and arranged all the material, played keyboards on all of the cuts, played percussion on some of them and also produced the recording.

All in all, a refreshing jazz album. (D.H.)

★ ★ ★

NO MORE INTERVIEWS. John Mayall. DJM Records. L 37163. Festival release.

Mayall, the oldest exponent of the British blues scene still keeps turning them out. Ever the perfectionist, Mayall changes his band line-up although, as in his previous album, he includes female back-up vocals. The sound is tight, funky rhythm and blues; horns complement normal bass and drums.

The tracks on the album are: Hard Going Up — A Bigger Slice Of Pie Falling — Take Me Home;Tonight Sweet Honey Bee — Stars In The Night — Consideration — Gypsy Lady — Wild New Lover.

A pleasing album which Mayall fans will doubtless want to snap up. (D.H.)

★ ★ ★

FABLE, FROM THE BEGINNING. FBAB 5327. Astor release.

Local label, Fable, celebrates its first 10 years with this interesting release containing 20 of its popular tracks, including: The Pushbike Song — Old Man Emu — Through The Eyes Of Love — Let Go — Boom Sha LaLaLo — Up There Cazaly — Waterloo Road — Knock Knock Who's There — She's My Kind of Woman — Julianna — Curly.

Some of the artists represented include Johnny Chester, Liv Maessen, The Hawking Brothers, Matt Flinders and the late Smacka Fitzgibbon. The quality is good throughout, making in all an enjoyable showcase of local talent. It gives you a shock to realise how long ago you first heard some of these songs! (N.J.M.)

Books & Literature

Optics Handbook

ELECTRO-OPTICS HANDS (Electro-Optics Series, Volume 3). By Glen R. Elion and Herbert A. Elion. Published by Marcel Dekker, Inc, 270 Madison Avenue, New York 10016. 1979. Bound and illustrated, 160 × 235mm, 360 pages. Price in USA $39.75.

This comprehensive book is the result of an effort to integrate previously scattered data concerning electro-optics engineering. In this respect the authors have achieved their aim. Apart from the detailed 14 chapters, there are a total of 123 figures and 76 tables.

The first couple of chapters deal with fundamental definitions, symbols, designations and conversions, allowing the reader to understand the remaining chapters.

The depth of each chapter reveals that this book is not intended for casual reading but for use as a source of information that is up to date and comprehensive. A background in Optics and Physics is necessary to fully understand the contents and consequently is only suitable for engineers and physicists who require the basic data for evaluation, selection and proper application of electro-optic devices and materials.

Subjects covered include: sources of radiation; lasers; detectors; image and camera tubes; optical formulas, materials and components; displays and arrays; communication systems; specialised electro-optic components and computer design.

We received our copy direct from the publishers, but we expect the book to be available from local technical book shops in the near future.

Electronic Games

ELECTRONIC GAMES by R. A. Penfold. Published 1980 by Bernard Babani Publishing Ltd, London. Stiff paper covers, 91 pages, 180 × 107mm, illustrated by circuits and diagrams. Price in Australia $5.25.

As distinct from many recent "theory" books from Babani, this one is devoted principally to constructional projects for the hobbyist.

All told, it contains circuit information for 19 games of which seven are classified as "simple". These include "Heads or tails", "Quiz monitor", "Steady hand", "Reaction game", and so on.

Among the more complicated games is a random number selector, a "One Armed Bandit", reaction time, electronic die, noughts and crosses and a combination lock game . . . plus others, of course.

All of these are self-contained party games intended for home construction. The author is not concerned with the kind of thing involving a TV set.

Circuits are given and some layouts on Veroboard, plus an explanation of how each circuit operates. Other details are left to the constructor.

In assessing the merit of an array of circuits like this, a certain amount has to be taken on trust. However, the information appears to be responsibly presented and 19 fun projects for $5.25 should be sufficient to attract quite a few hobbyists. Our copy came from Technical Book & Magazine Co Pty Ltd, 289 Swanston St, Melbourne 3000. (W.N.W.)

Vertical Antennas

THE AMATEUR RADIO VERTICAL ANTENNA HANDBOOK. By Capt P. H. Lee, USNR, K6TS. "CQ" Technical series, published 1974 by the Cowan Publishing Corp, New York. Stiff paper covers, 136 pages, 227 × 151mm, freely illustrated. Price in Australia $7.90.

One tends to expect a book on amateur band antennas to progress through the usual basic theory towards a series of widely accepted designs and thence on through feed systems and feedlines. But the title of this one, and the ranking of its author hints and something different, and it is.

Capt Paul Lee confesses to having long been a devotee of vertical antennas and a convert to the principle that, if you want good DX, you have to concentrate all the RF in one major, low-angle lobe. And the focus is, of course, on HF.

He looks first at optimum antenna design but progresses to foreshortened antennas, stacked elements, broadbanding and directional arrays. The earth and earth mats receive due attention. This takes him through to chapter 12,

Getting to Grips with Exidy Sorcerer Basic

INTRODUCTION TO SORCERER BASIC, by John and Judy Deane. Stiff paper covers, 89 pages plus appendices, 297mm × 212mm, illustrated by diagrams. Published by Dick Smith Electronics Pty Ltd. Price $9.95.

The Exidy Sorcerer, distributed in Australia by Dick Smith Electronics, is a very good computer for its price. However, in common with many other small computers, the documentation which accompanies it is rather scanty.

To remedy this situation Dick Smith has published "Introduction to Sorcerer Basic", a manual designed for the person who has no previous experience with computers, and may indeed be a little over-awed by the mysteries of computer programming. It must be said that the authors go out of their way to make the user feel at home with their computer, eg, "Look at that! It printed 10 times and stopped! Wow! That IF/THEN statement did all the work, and it's a beauty."

The book assumes no prior knowledge of computers, and begins with a chapter entitled "Can I turn it On?" which covers the interconnection of the components of the system and basic operation. It then goes on to discuss each statement and command provided by Sorcerer Basic (an 8k version of Microsoft Basic).

Each chapter (there are 28 altogether) covers two or three Basic statements, explaining clearly what each statement does and how it is used in a program and concluding with a summary of the points covered. Also included are chapters on program development, debugging, and cassette operation, a glossary and four appendices; a summary of Basic, Error messages, answers to exercises, and ASCII codes, memory usage and interface connections, etc.

Written in a very readable, friendly style, the book leads the reader in gradual steps from the fundamentals of operation of the Sorcerer to the writing of complex programs, providing many useful examples, and a series of graded programming exercises.

Also valuable are the three chapters on using the Sorcerer graphics capabilities, as this subject was sketchily treated in the Exidy manuals.

Altogether the book is well written and very comprehensive, forming an excellent introduction to the Sorcerer and to Basic. Experienced users may be put off slightly at times by the "gee whiz!" approach in places, but if they don't allow this to deter them they will also find "Introduction to Sorcerer Basic" extremely useful, as it includes information that I have not seen elsewhere in the literature on the Sorcerer.

Our review copy came direct from Dick Smith Electronics, and copies should be available at Dick Smith stores by the time you read this. (P.V.)

with chapters 13 to 18 inclusive covering suggested 4-band designs. Questions and answers and an index round out a book that abounds with diagrams, data and performance curves.

So heave-ho me hearties. Forget the landlubbers with their pipes and their plumbing and join the captain in the rigging!

Our review copy came from McGills Newsagency, 187 Elizabeth St, Melbourne 3000. (W.N.W.)

Hifi Systems

CHOOSING AND USING YOUR HIFI by Maurice L. Jay. Published 1980 by Bernard Babani (Publishing) Ltd, London. Stiff paper covers, 90 pages, 180 × 108mm, with diagrams. Price in Australia $4.95.

One avowed intention of this book is to better equip the reader to select their own hifi equipment from what is offering. A certain amount of advice is offered but, overall, one gets the impression that the author has been content to write in general terms rather than to really address himself to specifics.

Spot reading also unearthed paragraphs that I wasn't happy about.

P14 could be taken to mean that the relationship of "RMS" power to peak power is 0.707; it is 0.5. P16 talks about power bandwidth without mentioning the vital figure "−3dB". P21 contains an odd statement about damping factor and loading. P22 repeats that hoary old misstatement about the input impedance of the speaker needing to match the output impedance of the amplifier. P23 carries the implication that the volume control has to reconcile the dissimilar outputs from phono cartridge and tuner; what happened to the phono preamplifier?

Frankly, I was not impressed. Our review copy came from the Technical Book and Magazine Company Pty Ltd, 289-299 Swanston St, Melbourne 3000. (W.N.W.)

Philips Quarterly

Philips' quarterly publication "Electronic Components & Applications" is intended for equipment designers, laboratories, research organisations, eductional establishments, consultants and libraries, and is jointly published by the Electronic Components and materials Division of Philips Industries, Eindhoven, the Netherlands, and Mullard Ltd, London, UK.

"Electronic Components & Applications" derives its content from research, applications and quality control laboratories and factories. All aspects of contemporary electronics will be covered such as telecommunications, data processing, industrial control and automotive, domestic and consumer electronics. The subscription rate per volume (four issues) is $14.00 pa.

Microcomputer News & Products

Sigma Data set for office revolution — word processors, computers, disc filing systems

The stiff collars, high stools and quill pens that once characterised the business office have given way gradually to casual clothes, swivel chairs, electric typewriters and the copiers that are now part of the everyday scene. But, if Sigma Data have their way, the next few years will see a further major revolution in corporate administration: the integrated electronic office or IEO.

by NEVILLE WILLIAMS

The Sigma scenario envisages a much higher level of automation, with a given number of people coping with a much greater volume of meaningful work. Machines will take over and streamline many of the time-wasting activities which characterise present-day methods.

The elements for Sigma's electro-Utopian revolution already exist in the inventories of various companies — world processors, computers, magnetic disc filing systems, electronic message switching facilities and so on. Sigma is saying that to equip an office with individual bits of such hardware is doing only half a job. The hardware should be planned and blended into one harmonious system, so that each unit complements the other in terms of work flow; hence their key word "integrated".

Needless to say, the hardware for the IEO revolution would be as supplied or endorsed by Sigma!

The Sigma concept was presented to the Australian technical business press during May, at a function in the Sydney Opera House complex. While hosted by Sigma Data Chairman and Managing Director Michael Faktor, the concept was introduced and explained, for the most part, by Daniel A. Hosage, Senior Vice President and General Manager of Sigma Data's principals: Datapoint Corporation, USA.

Daniel Hosage is no stranger to the office computer scene. He spend 15 years with IBM, ending up as Product Manager for a major part of the system 360 line. He then joined Recognition Equipment Inc, of Dallas, as Vice President of product programs. In 1971 he was a co-founder of Action Communications Systems, which did pioneering work on the area of computerised telephone control and accounting systems. He has been with Datapoint Corporation since 1975 and is now General Manager of its Office Systems Division and directly responsible for its Integrated Electronic Office planning.

In December last, Daniel Hosage had introduced the Integrated Electronics Office concept to a generally favourable press in the USA. The plans in hand for Australia are necessarily more tentative, partly because of the smaller market and partly because some of the communications aspects in this country (as in the UK) have to be reconciled with the virtual communications monopoly exercised by the respective governments.

Even so, as Datapoint's distributors in Australia, Sigma are in a sound position to cope, with eight branches and 270 employees. As Managing Director Michael Faktor pointed out, Sigma's own operation could provide a living laboratory for the IEO system. For example, with an annual telephone bill edging towards $500,000, savings through rationalisation of that outlay alone could be considerable.

In fact, the whole thrust of IEO, he claimed, was that expenditure on new system hardware could be recouped by savings in a relatively short time. Obvious target for initial approaches would be Sigma Data's existing 800-odd customers in Australia.

At the heart of the IEO system is a resource that was originally developed to interconnect small Datapoint computers within any one organisation, to increase their total power. Out of this came — in 1977 — what Datapoint now call their ARC or "Attached Resource Computer" system architecture. They explain ARC this way, in typical industry jargon:

"Datapoint's ARC system utilises an interprocessor bus which connects applications and file processors which are dispersed throughout a company.

"The interprocessor bus permits access to the common database and acts as a pathway for the movement of all information contained within the system.

"This architecture places computer power within the reach of all those needing it within the corporation."

The step from the ARC system to an integrated electronic office involves the planning and merging with ARC of other modern office facilities, such as word processors and phone message handling "at small incremental cost".

The word processors, for example, operate "on line", thereby greatly increasing their potential. They can, if need be, serve as self-contained "state of the-art" intelligent typewriters but they can also access and incorporate informa-

Club News:

MELBOURNE MICROCOMPUTER CLUB

Micom, the Microcomputer Club of Melbourne, is made up of a number of user groups, each concentrating on a particular computer system, with each group chairman a member of the Executive Committee.

The club publishes a newsletter containing information on hardware and software, plus reviews of new products and books on microcomputing, and meets on the third Saturday of each month at 2pm at the AMRA Hall, Willis St Glen Iris, Melbourne. They can be contacted by mail at PO Box 60, Canterbury 3126.

BRISBANE MICROCOMPUTER GROUP

The Brisbane IREE Microcomputer Interest Group meets on the second Friday of each month at the Old Brisbane Town Hall, on the corner of Vulture and Graham Streets, South Brisbane. The doors open at 7pm and meetings commence at 7.30pm.

Mr Daniel A. Hosage, Senior Vice President and General Manager, Datapoint Corporation, USA. In the background is the Datapoint 1500 word processing system.

tion from a common data base.

To quote Harold O'Kelley, President and Chief Executive Officer of Datapoint:

"Using any of these processors, employees can create, edit, modify, format, reformat and comprehensively manipulate documents such as correspondence, technical manuals, price schedules, internal memos and any other text required within the business environment.

"Datapoint's word processing system also features simplified editing, easy-to-learn-and-easy-use commands, flexible format elements such as page justification, line spacing and tab settings and the ability to "scroll" or review stored text on a processor's screen for the most convenient editing and correction.

"Datapoint is offering a high quality 45cps printer with word processing and electronic message systems which provides the finest typewriter-like print for routine word processing tasks."

As a further function, the information collated on screen can be transmitted in message form directly to one or more other word processors throughout the organisation. Receipt of such messages can be instantly acknowledged. Used properly, this facility can eliminate a large proportion of the physical memo traffic between departments, ensuring delivery within minutes rather than the more usual "next day" situation.

Extending the acronymns, the system also offers AIM – Associated Index Memory. Documents passing through the system can be stored in a permanent memory bank and later accessed by nominating key words or phrases, dates, or the sender or addressee. Given such clues, the system will search through and nominate document(s) which satisfy the criteria and allow the operator at the viewing screen to "thumb through" them to locate the exact reference required.

The handling of all such traffic and messages is the responsibility of Datapoint's "Electronic Message System", which has the ability to sort the traffic and to respond to encoded instructions indicating priorities: immediate, urgent, regular and overnight. Provision can be made for security by automatic encryption – or scrambling.

In the area of voice communication, Sigma are offering automatic call distribution (ACD) equipment which integrates with the phone system and allows its operation to be monitored to any desired level.

Questioned about privacy problems and possible staff attitudes, a Sigma spokesman said that ACD equipment would not typically be adjusted to record each individual call; it might, however, be set to indicate phone usage on a departmental basis and, by dropping the last couple of digits, provide an indication of the STD zone, duration and cost of such calls. Given this information, planning and rationalisation would be possible, leading to significant savings.

As a further potential saving Datapoint (and Sigma) are in a position to offer an infra-red system – Lightlink – which can carry voice and data over optical distances. While Datapoint in the USA can say "requires no federal registration or licensing", the same would not apply in Australia for paths outside the private property boundaries of a company or institution.

But, for the time being, Sigma will probably be content to leave that problem in the "too hard" basket!

Microcomputer News & Products

Datapoint 10 megabyte cartridge disc drive

Sigma Data Corporation has announced a Datapoint 10 Megabyte removable disk cartridge system, which will be ready for delivery later this year. The new 9320 disk drive is designed to provide extended storage capability for Datapoint entry-level users with 1500 or 1800 Dispersed Processors. It consists of a disk drive, controller, and a four-terminal serial interface, packaged in a desk-top unit.

At the same time, Sigma Data Corporation released details of its new direct data communications link with the central computer system at Datapoint, San Antonio, Texas. The Datapoint in-house ARC (Attached Resource Computer) system consists of more than 200 Datapoint processors and the direct communications link will significantly enhance Sigma Data's software support capability, enabling its system engineers to receive quick solutions to system software problems.

Sigma Data Corporation is at 157 Walker St, North Sydney, 2060.

Compucolor users group

Users of the Compucolor II have formed a users group in Sydney and Melbourne. Meetings are held on the first Tuesday of the month, at 6pm at The Logic Shop, 91 Regent St, Chippendale, and at 7.30pm at The Logic Shop, 212 High St, Windsor, Vic. For further details, contact The Logic Shop Sydney on 699 4919 or Melbourne 51 1950.

New Teleray terminal from ADE

Anderson Digital Equipment has just released the latest Teleray Terminal, the Model 12T. The Model 12T is an "intelligent" terminal, with a 48 line (3840 character) display memory and a 24 line rolling display window. In addition there is a 7500 character function memory which can be shared by up to 32 programmable function keys. Text, forms, and control sequences can be stored in this memory and accessed by a single key.

All standard editing features are available, and can be programmed in any combination. There is also a "secure" function should the user need to enter unseen data such as a password. Switchable baud rates from 50 to 9600bps and full duplex operation are standard.

The Model 12T derives its name from the "T" shape of the attached keyboard. Like all other Teleray terminals, the

Model 12 can be purchased with a removable keyboard (Model 12M) or in a rack mounted model (Model 12R). The unit price is expected to be approximately $1995, and delivery is currently 90 days from order, although ADE expect to have a stock of the terminals by August.

For further information contact Anderson Digital Equipment, PO Box 322, Mt Waverley, Vic 3149, or PO Box 294, Ryde, NSW, 2112.

Sydney Home Computer Show a success

The Home Computer Show was held in Sydney on May 22-25, and from all accounts it was a great success, with many firm orders being received by exhibitors in addition to the thousands of enquiries. Ten thousand visitors to the show saw exhibits by 28 organisations, and the overall impression was that home computers are no longer a novelty but a mature concern capable of arousing a great deal of interest and offering considerable commercial prospects.

From the many displays it is hard to single out those most worthy of attention. Of course the Apple II was there, playing Invaders and Space Wars, and coupled to a video camera and colour printer to produce computerised portraits. Commodore was well represented, with both the PET and the CBM business sytem on display. The exhibit by The Logic Shop featured the Compucolour II, along with the Sendata acoustic modem, one of the few approved for use in this country.

A big display by Tandy demonstrated the TRS-80 in various versions, and close by was the Micro-80 stand, offering their magazine and a selection of software for the TRS-80, along with the Exatron Stringy Floppy, a high speed data recorder which is not yet widely known in Australia, although very popular in the United States. Dick Smith Electronics

MICRONEWS CONTINUED ➔

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AND PROVISION FOR AN ADDITIONAL UNIT. (TANDY ONLY ALLOWS THE USE OF ONE!)

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and features have been added. In our opinion, the greatest disadvantage of the TRS-80 is the fact that it it not S-100 Bus compatible, meaning that the fantastic range of S-100 products (speech synthesizers, disk controllers etc.) are not readily usable. This problem has now been solved with the

DICK SMITH SYSTEM 80

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BASIC SPECS:

- ★ Z-80 microprocessor
- ★ Takes two cassette players – one is built in!
- ★ RF output direct to TV set (video output as well!)
- ★ 12k Tandy compatible BASIC
- ★ 16 lines of 64 characters or 32 characters
- ★ 128 x 48 graphics matrix
- ★ Dick Smith backup
- ★ Expansion with S-100 system

When comparing Tandy TRS-80 with level II BASIC, 16k RAM and cassette recorder ($1019.50) with System 80 16k ($695.00),

YOU SAVE 32%

SYSTEM 80
With Level II BASIC (12k); Inbuilt recorder; Demonstration tape; Inbuilt TV modulator; 4k RAM:
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$695
Cat. X-4005

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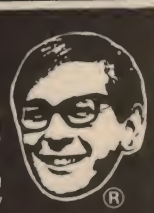

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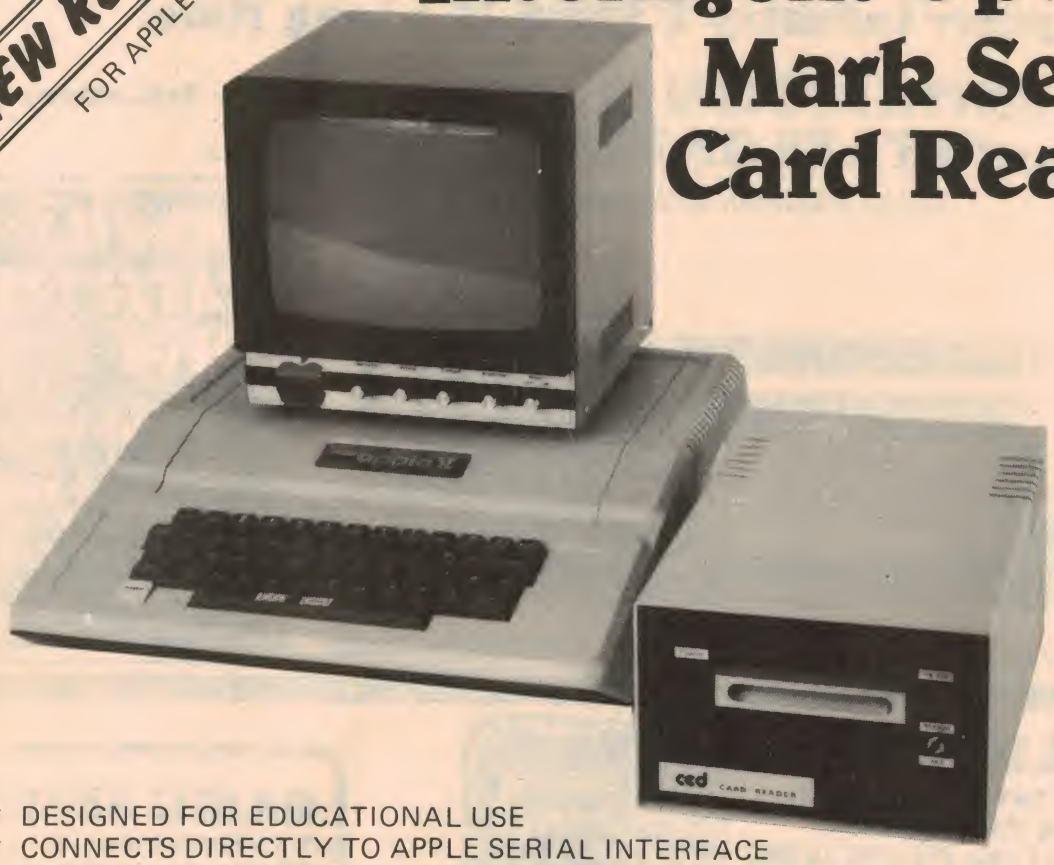

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* APPLE BASIC CARDS GIVE EASE OF PROGRAMMING
* NO SOFTWARE REQUIRED – UTILIZES BUILT-IN MICROPROCESSOR & FIRMWARE
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* CAN BE LOCATED AWAY FROM APPLE FOR REMOTE JOB ENTRY
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* EXECUTIVE SOFTWARE ON DISK GIVES HARD COPY LISTING & RUN OF PROGRAM ENTERED
* LOW COST
* HIGH SPEED
* RUGGED CONSTRUCTION
* HIGH RELIABILITY

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Microcomputer News & Products

displayed the Sorcerer computer and the long-awaited System 80, which comes complete with Tandy compatible Level II Basic and 4K of RAM for around $600, including a built-in cassette recorder.

Cromenco systems were also exhibited, and the complete range of TCG/Ohio Scientific systems were on display. For the newcomer to the field J.R. Components showed off the DREAM 6800, and on another level altogether Electron Computer was there with their wide range of Data General microNova 16 bit machines. Specialised uses of microprocessors such as the "Sargon 2.5" chess module and the Compucruise car computer also attracted many visitors.

Acoustic Electronic Developments, Pty Ltd a small Sydney-based computer company, presented a good display of S-100 boards from George Morrow, Solid State Music, Godbout and others. They aim to combine their own products with imported equipment, offering their customers the best of both worlds.

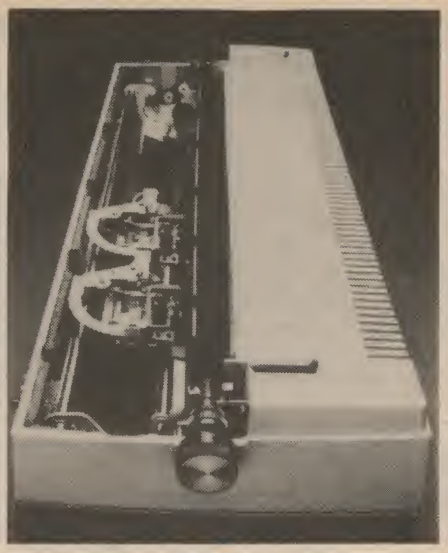
Suppliers of software were also very evident, with everything from games to complete business packages available for all the popular small computers on display. The Technical Bookshop presented an extensive range of computer-related literature, covering home computers, business applications, and student needs. Altogether, there was something for everyone at the show.

The Home Computer Show will be coming to Melbourne, at the Kew Civic Centre from September 11-14th and indications are that it will be even bigger than the Sydney show. Certainly it's an event not to be missed.

Two heads are better than one

For printing, two heads may well be better than one, especially when the heads are daisy print wheels operating in parallel, as in the new Qume Twin Track printer from Anderson Digital Equipment Pty Ltd. The Twin Track printer has been specially designed to solve complicated printing problems by providing two daisy wheel print heads which operate independantly, doubling the character set available for a given task.

The Twin Track allows a new convenience in printing applications which require special characters, symbols, or alphabets. One print head can type text, while the other prints the required symbols in the proper place. Any combination of type fonts can be used on-line, to a total of 192. It is possible, for example, to build a word processing system that prints text in Swahili while simultaneously typing out an English translation – side by side.



Alternatively both print heads can use the same character set, and printing speed can be doubled. Letter quality copy can be made at rates up to 75 characters a second, in parallel columns or as solid text. Like other Qume printers, Twin Track print heads operate bidirectionally, printing left to right, then right to left.

Current availability of the Twin Track is 90 days from the date of order. Anderson Digital Equipment may be contacted at PO Box 322, Mt Waverley, 3149, or PO Box 294, Ryde, NSW 2112.

University of NSW radio courses

The University of NSW is offering several courses over Radio University and Television University in late July which will be of interest to anyone working with microcomputers or microprocessors.

An introductory course in Basic will cover programming, flowcharting techniques, and error diagnosis and debugging. Students in the course will be shown how Basic is run in timesharing and batch modes on university terminals and will have a chance to use the terminals themselves. The five radio lectures will be broadcast over Radio University's station VL2UV at 7pm Mondays and repeated at 8pm Fridays, and two televised lectures will be transmitted on Tuesday evenings to Television University's four viewing centres in the metropolitan area.

Two new courses on microprocessors will also be broadcast by Radio University. The first course, Microprocessor Fundamentals (10 lectures), will assume only general experience in the area. The second course, of 20 lectures, entitled An Introduction to Microprocessor Systems, covers the same ground as the first course, and proceeds to more advanced programming techniques, software, and peripherals.

Radio University's station VL2UV broadcasts on 1750kHz, just off the broadcast band, and can be received in the Sydney area by a simply-modified radio. Small transistor radios already modified can be purchased from Radio University at a cost of $7.

Further details of the courses can be obtained from the Division of Postgraduate Extension Studies, 16th Floor, Mathews Building, University of NSW. Telephone 662 2691.

Z8 single-board computer has BASIC

A single-board computer based on the Z8 and featuring a Z8 Basic/Debug interpreter has been introduced by Zilog Inc. The board is designed for a wide variety of fast data processing and data acquisition applications, and although only 100m by 158mm, it can accommodate up to 8K of RAM, ROM, or EPROM in any combination.

Included on the board are two

MICRONEWS CONTINUED

Microcomputer News & Products

counter/timers, five eight-bit parallel I/O ports, a programmable asynchronous serial interface, 124 general purpose registers, and three levels of interrupts. The board's Basic/Debug interpreter, specially designed by Zilog, is masked onto the 2K internal ROM of the Z8, and is a subset of the original Dartmouth Basic, simplified and modified to meet the needs of board level applications.

The Z8-SBC is the first of a family of compatible microcomputer boards planned by Zilog. Other boards will provide a floppy disk controller, a terminal interface, expanded memory, and digital and analog input and output functions. A 96-pin and socket connection system will allow each board to interface with a bus structure specially developed by Zilog for the board family.

For further information contact ZAP Systems Pty Ltd, 51-53 Chandos St, St Leonards, NSW 2065, who are Zilog distributors in Australia.

NS VAX-11/7 compatible memory

A new high-speed, high-density memory board that packs 512K bytes on a single card has been introduced by National Semiconductor Corporation. Designated the NS780, the memory board is compatible with DEC's VAX-11/780 32-bit minicomputer, and is a direct replacement for DEC's M8210 memory. For further information, write to NS Electronics, PO Box 89, Bayswater, Vic 3153.

Stud programs for livestock breeders

A set of computer programs designed for livestock breeders has recently been released by Computerland of Melbourne.

The set of programs, called "Stud Book", can replace or add to a system of written records. The programs are written in Basic for use on the Apple II personal computer.

Uses of the "Stud Book" programs are varied. They can be used, for example, to:

- *print family trees;*
- *list all the offspring of any animal;*
- *list animals with a particular characteristic;*
- *list animals with a certain range;*
- *select animals with a combination of characteristics;*
- *list all information for any animal; and*
- *list animals bought or sold.*

The programs can be used for studs of up to 100 animals, and are available in two versions. The first version is for animals identified by tag numbers, eg sheep, cattle and goats; the second is for animals identified by names, eg horses, dogs, cats etc.

"Stud Book" programs are available for demonstration at all Computerland of Melbourne stores, and require an Apple II personal computer with 48K bytes of memory, a video monitor, and a disk drive.

Further information is available from Computerland of Melbourne, 555 Collins St, Melbourne, Vic 3000.

Revised prices

Since authorising the advertisement on p104 of our June issue, South West Technical Product Corporation advise that two of the prices quoted have had to be revised upwards, as follows:

69/K Computer Kit..... $660
69/A Assembled Computer $760
69/56 Assembled Computer $1660

These prices do not include sales tax. Enquiries to SWTPC, 7a Burton St, Darlinghurst, NSW 2010.

MICRONEWS CONTINUED ➔

DATA 80: helping the community to come to grips with computers

Already held in Melbourne, and coming soon to Sydney and Adelaide, DATA 80 promises to be the most impresssive computer exhibition so far held in Australia. With over 70 exhibitors and more than $25 million worth of equipment, and supported by private and governmental organisations, the series of displays and seminars will be an opportunity for the businessman and the community to come to grips with the growing use of computers.

The last five years have been a time of spectacular growth in the computer industry, both in Australia and overseas. Constant development and a growing perception of the commercial advantages of computerisation have combined to bring about changes in working conditions that are still not fully understood. And the wide range of equipment available has not made the position of the businessman contemplating the initial step into computers any easier.

In an attempt to monitor and assist developments in the field, the Australian Computer Society (NSW), the Productivity Promotion Council of Australia, and the Federal Department of Productivity joined forces in 1977 to sponsor "DATA DAY", a series of exhibitions and seminars designed to allow both potential and experienced computer users to become acquainted with new developments in the area.

Since 1977, DATA DAY has grown into Australia's largest annual computer event, leading to "DATA WEEK '79", held in Sydney, Melbourne, and Adelaide last year, and to DATA 80, this year's exhibition. DATA 80 will provide first-time users and experts with an opportunity to inspect the great variety of computer systems on the market, in one place at one time; and to hear professionals speak on various aspects of computerisation in manufacturing, in small businesses, and the environment of the future.

The Melbourne DATA 80 exhibition was held on May 28-29 at the Southern Cross Hotel, and comes to Sydney at Centrepoint on August 5-7, and to Adelaide at the Oberoi Hotel on November 12-13. More than 70 companies have entered DATA 80, presenting over $25 million worth of equipment and services. From the standardised hardware and software available in 1977 the local industry has expanded to provide a vast range of new and established systems, together with specialised peripheral support products and services. DATA 80 will therefore provide an excellent forum for the dissemination for up-to-the-minute information on new technologies, and, it is hoped, discussion of the vital social issues presented by computerisation in all its forms.

For the first time this year DATA 80 will be open to the general public as well as to the industry. By publicising the event to the community at large, the promoters, Graphic Directions Pty Ltd, are confident that the exhibition will contribute to a wide public understanding of the role of computers in small business, and their impact on society as a whole. The important educative role of exhibitions such as this cannot be neglected, for computer technology is not the esoteric province of a handful of professionals, but a community resource to be shared by all.

The wide-ranging display of new equipment will be accompanied by a series of seminars providing expert guidance on buying and using computer systems. This year's topics will cover three areas – "Buying your Computer – Choosing the right system" (Day 1); "Computers in Manufacturing – Now and in the Future" (Day 2); and "The Electronic Office – Word Processing and Other Realities" (Day 3).

Seminars held at the Melbourne exhibition on computers in the manufacturing industry sparked a great deal of debate. For example, Barry Parsons, managing director of Godfrey Hirst Australia Pty Ltd, spoke of the shortage of qualified technicians, programmers and analysts, and predicted a deterioration in the situation in Australia during the next five years. He reasoned that some form of retraining scheme is an urgent necessity if the expanding use of computers is to be successful.

Many of the speakers at the Melbourne seminars emphasised the importance of overcoming the distance between various specialised disciplines. As Dr Michael Fagan said, speaking of computers in manufacturing, "Usually people know about either computers or manufacturing; there is a lack of knowledge in the middle."

Similarly, the combination of the two technologies of telecommunications and data processing will be immensely important in the future. The common trend in word processing systems, for example, is towards the automatic transmis-

MICRONEWS CONTINUED

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JOHN F.ROSE COMPUTER SERVICES PTY.LTD.

PRINT SAMPLE SHEET

This is a printing sample by our newly developed matrix printer which has a 16 wire head designed for producing wordprocessing quality print at high speed.

17 x 16 matrix at the print speed of 75 cps is available for good printing quality, and 9 x 7 matrix at the print speed of 150 cps is available for high speed printing.
(Print speed can be increased by 20% by using the 12 cpi mode.)

The printer has 2 sets of dot matrix patterns in the character generator as standard (including JIS 8 bit-code)
This line is printed at 12 cpi.

```
 !"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[¥]^_
`abcdefghijklmnopqrstuvwxyz{|}¯
 。「」、・ヲァィゥェォャュョッーアイウエオカキクケコサシスセソ
タチツテトナニヌネノハヒフヘホマミムメモヤユヨラリルレロワン゛゜
```

```
 !"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[¥]^_
`abcdefghijklmnopqrstuvwxyz{|}¯
 。「」、・ヲァィゥェォャュョッーアイウエオカキクケコサシスセソ
タチツテトナニヌネノハヒフヘホマミムメモヤユヨラリルレロワン゛゜
```

Other type fonts can be specified by the user.
An important feature of the printer is the ability to define special characters under external software command. For example ***NDK***.
Various patterns may be printed at rate of 900 dot-column per second and resolution of 120 dot per inch.

Price excluding sales tax $3105.00. Send $1.00 to join our mail list club and receive our latest catalogue.

Manufactured by: Nikkyo Electric Industry Co, Ltd, 807 Futoo-cho, Kohoku-ku, Yokohama, 222 Japan.

Distributed in Australia by:

JOHN F. ROSE COMPUTER SERVICES PTY LTD
33-35 Atchison Street, St Leonards, NSW 2065
Telephone: (02) 439 1220 Telex: AA27901.

Microcomputer News & Products

Sord Mark VI computer system

Mitsui & Co (Australia) Ltd recently released details of their new Sord Mark VI computer system, the M200. The system uses a Z80A (4MHz) CPU, in conjunction with an arithmetic processing unit (ALU) and an 8M byte disk drive. Mathematical operations formerly processed by software are now carried out by a special LSI processing unit, and a Z80 CPU is also incorporated in the disk controller, resulting in a processing speed three to five times faster than previous Sord models.

The mark VI includes a 350K byte mini-floppy disk drive as standard, to provide back-up support for the Winchester-type hard disk drive. Extensive software is available for the system, including business application programs, a relocatable assembler, Cobol, Fortran-IV, and several versions of Basic adapted to various special purposes, including "EBasic", which works with the APU.

Details can be obtained from The Small Business Computer Company, 200 Pacific Highway, Crows Nest, NSW, 2065.

Low-cost Z80 personal computer

The Sinclair ZX80 personal computer is a complete small system, with Basic, which sells in Britain for less than £100, and is currently creating a lot of interest in Europe. Now, Consolidated Marketing Pty Ltd, of Melbourne, has announced plans to begin importing the ZX80, and expect to have it on sale by August of this year. Watch this column for further details.

DATA 80 computer exhibition

. . . from p121

sion of text beween remote machines using telephone lines, and DATA 80 will allow visitors to see for themselves the range of word processing equipment available and hear experienced consultants and users speak on the subject.

The Australian Computer Society will also be actively participating in the exhibition, offering professional advice on how to approach the major decision of whether or not to use a computer in a particular application; if so, how to choose a system that fits the requirements. As the president of the Society, Ted Wastie, puts it: "The aim is to encourage people to have a realistic approach which correctly identifies the best areas to tackle first with the computer selected. The wrong step can be excessively expensive. It can also be fatal."

The speed of change in the computer industry tends to surprise even the experts, and perhaps leave the general public bewildered. The aim of DATA 80 is to try to help the public, and the small businessman in particular, achieve a greater understanding of the uses of computers, and to face the future computer society with confidence.

Data cassette for the hobbyist

A data cassette designed for personal microcomputers has been introduced by 3M Australia's Data Recording Products Division. Available in both 10 minute and 30 minute lengths, the new 830 cassettes are individually packaged in plastic album cases. Suggested price for the 10 minute album is $2.10; for the 30 minute album, $2.33.

Additional information is available from the Data Recording Products Division, 3M Australia Pty Ltd, PO Box 99, Pymble, NSW 2073.

Development system from Zilog

A complete, single board microcomputer system designed to assist in development and evaluation of hardware and software for systems based on the Z8 single-chip microcomputer has been introduced by Zilog Inc.

The Z8 Development Module uses the 64-pin version of the Z8 microcomputer to prototype a Z8 based system. The code thus developed can later be transferred to the ROM on the mask-programmed 40-pin version of the Z8.

MICRONEWS CONTINUED

No.12: WRITE FOR FREE CATALOGUE *

Gourmet Goodies

Software for most popular 8080/Z80 computer disk systems including* **NORTH STAR, ICOM, MICROPOLIS, DYNABYTE DB8/2 & DB8/4, EXIDY SORCERER, SD SYSTEMS, ALTAIR, VECTOR MZ, MECA, 8" IBM, HEATH H17 & H89, HELIOS, IMSAI VDP42 & 44, REX, NYLAC, INTERTEC SUPER-BRAIN, VISTA V80 and V200, TRS-80* MODEL I and MODEL II, ALTOS, OHIO SCIENTIFIC, DIGI-LOG, KONTRON PS180, IMS 5000 DISKETTE** *formats and* **CSSN BACKUP** *cartridge tapes.*

Genuine CP/M for Apple II coming soon! Call for details.

Prices reflect distribution on 8" single density diskettes If a format is requested which requires additional diskettes a surcharge of $8 per additional diskette will be added A surcharge of $25 will be added for software on CSSN format DC 300XL cartridges

CP/M* VERSION 2 FOR TRS-80 MODEL II NOW AVAILABLE

All Lifeboat programs require CP/M, unless otherwise stated.

Software with Manual / Manual Alone

☐ **CP/M* FLOPPY DISK OPERATING SYSTEM** — Digital Research's operating system configured for many popular micro-computers and disk systems:

System	Version	Price
North Star Single Density	1.4	145/25 v
North Star Double Density	1.4	145/25
North Star Double/Quad	2.x	170/25
iCOM Micro-Disk 2411	1.4	145/25
iCOM 3712	1.4	170/25 v*
iCOM 3812	1.4	170/25 *
Mits 3202/Altair 8800	1.4	145/25
Heath H8 + H17	1.4	145/25 Ⓜ
Heath H89	1.4	145/25 Ⓜ
TRS-80 Model I	1.4	145/25 Ⓜ
TRS-80 Model II	2.x	170/25
Processor Technology Helios II	1.4	145/25
Cromemco System 3	1.4	145/25
Intel MDS Single Density	1.4	145/25
Intel MDS Single Density	2.x	170/25
Intel MDS 800 Double Density	2.x	200/25
Intel MDS 230 Double Density	2.x	200/25
Micropolis Mod I	1.4	145/25 v
Micropolis Mod II	1.4	145/25 v

The following configurations are scheduled for release during the first half of 1980:

North Star Double/Quad + Corvus	2.x	250/25
North Star Horizon HD-1	2.x	250/25
Ohio Scientific C3	2.x	200/25
Ohio Scientific C3-B	2.x	250/25
Ohio Scientific C3-C	2.x	250/25
Micropolis Mod II	2.x	200/25
Mostek MDX STD Bus System	2.x	350/25 **
iCOM 3812	2.x	225/25 *
iCOM 4511/Pertec D3000	2.x	375/25 * +
TRS-80 Model II + Corvus	2.x	250/25

*Software consists of the operating system, text editor, assembler, debugger and other utilities for file management and system maintenance. Complete set of Digital Research's documentation and additional implementation notes included. Systems marked * and ** include firmware on 2708 and 2716 Systems marked + include 5440 media charge. Systems marked Ⓜ require the special Ⓜ versions of software in this catalog. Systems marked v have minor variants available to suit console interface of system. Call or write for full list of options.*

☐ **MP/M*** — Intel MDS single density only (Documentation includes CP/M 2.0 manuals) ..... **$300/$50**

☐ **Z80 DEVELOPMENT PACKAGE** — Consists of: (1) disk file line editor, with global inter and intra-line facilities; (2) Z80 relocating assembler, Zilog/Mostek mnemonics, conditional assembly and cross reference table capabilities; (3) linking loader producing absolute Intel hex disk file ..... **$95/$20**

☐ **ZDT** — Z80 Monitor Debugger to break and examine Ⓜ registers with standard Zilog/Mostek mnemonic disassembly displays. $35 when ordered with Z80 Development Package ..... **$50/$10**

☐ **XASM-68** — Non-macro cross-assembler with nested conditionals and full range of pseudo operations. Assembles from standard Motorola MC8800 mnemonics to Intel hex ..... **$200/$25**

☐ **XASM-65** — As XASM-68 for MOS Technology MCS-6500 series mnemonics ..... **$200/$25**

☐ **DISTEL** — Disk based disassembler to Intel 8080 or TDL/Xitan Z80 source code, listing and cross reference files. Intel or TDL/Xitan pseudo ops optional. Runs on 8080 ..... **$65/$10**

☐ **DISTLOG** — As DISTEL to Zilog/Mostek mnemonic Ⓜ files. Runs on Z80 only ..... **$65/$10**

☐ **SMAL/80** Structured Macro Assembler Language — ⓧ Package of powerful general purpose text macro processor and SMAL structured language compiler. SMAL is an assembler language with IF-THEN-ELSE, LOOP-REPEAT-WHILE, DO-END, BEGIN-END constructs ..... **$75/$15**

☐ **tiny C** — Interactive interpretive system for teaching ⓧ structured programming techniques. Manual includes full source listings ..... **$105/$40**

☐ **BDS C COMPILER** — Supports most features of lan- Ⓜ guage, including Structures, Arrays, Pointers, recur- Ⓘ sive function evaluation, overlays. Includes linking loader, library manager, and library containing general purpose, file I/O, and floating point functions. Lacks initializers, statics, floats and longs. Documentation includes "The C PROGRAMMING LANGUAGE" by Kernighan and Ritchie ..... **$125/$20**

☐ **WHITESMITHS C COMPILER** — The ultimate in sys- Ⓛ tems software tools. Produces faster code than a ⓧ pseudo-code Pascal with more extensive facilities. Conforms to the full UNIX* Version 7 C language, described by Kernighan and Ritchie, and makes available over 75 functions for performing I/O, string manipulation and storage allocation. Linkable to Microsoft REL files. Requires 60K CP/M ..... **$630/$30**

Software with Manual / Manual Alone

MICROSOFT

☐ **BASIC-80** — Disk Extended BASIC. ANSI compatible Ⓛ with long variable names, WHILE/WEND, chaining, Ⓜ variable length file records ..... **$325/$25**

☐ **BASIC COMPILER** — Language compatible with Ⓛ BASIC-80 and 3-10 times faster execution. Produces Ⓜ standard Microsoft relocatable binary output. Includes MACRO-80. Also linkable to FORTRAN-80 or COBOL-80 code modules ..... **$350/$25**

☐ **FORTRAN-80** — ANSI 66 (except for COMPLEX) plus Ⓛ many extensions. Includes relocatable object com- Ⓜ piler, linking loader, library with manager. Also includes MACRO-80 (see below) ..... **$425/$25**

☐ **COBOL-80** — Level 1 ANSI '74 standard COBOL plus Ⓛ most of Level 2. Full sequential, relative, and Ⓜ indexed file support with variable file names. STRING, UNSTRING, COMPUTE, VARYING/UNTIL, EXTEND, CALL, COPY, SEARCH, 3-dimensional arrays, compound and abbreviated conditions, nested IF. Powerful interactive screen-handling extensions. Includes compatible assembler, linking loader, and relocatable library manager as described under MACRO-80 ..... **$700/$25**

☐ **MACRO-80** — 8080/Z80 Macro Assembler. Intel and Ⓛ Zilog mnemonics supported. Relocatable linkable Ⓜ output. Loader, Library Manager and Cross Reference List utilities included ..... **$149/$15**

☐ **XMACRO-86** — 8086 cross assembler. All Macro and Ⓛ utility features of MACRO-80 package. Mnemonics slightly modified from Intel ASM86. Compatibility data sheet available ..... **$275/$25**

☐ **EDIT-80** — Very fast random access text editor for text Ⓛ with or without line numbers. Global and intra-line commands supported. File compare utility included ..... **$89/$15**

☐ **PASCAL/M*** — Compiler generates P code from ex- Ⓘ tended language, implementation of standard PAS- Ⓛ CAL. Supports overlay structure through additional procedure calls and the SEGMENT procedure type. Provides convenient string handling capability with the added variable type STRING. Untyped files allow memory image I/O. Requires 56K CP/M ..... **$150/$20**

☐ **PASCAL/Z** — Z80 native code PASCAL compiler. Pro- Ⓘ duces optimized, ROMable re-entrant code. All interfacing to CP/M is through the support library. The package includes compiler, Microsoft Compatible relocating assembler and linker, and source for all library modules. Variant records, strings and direct I/O are supported. Requires 56K CP/M and Z80 CPU ..... **$395/$25**

☐ **PASCAL/MT** — Subset of standard PASCAL. Gener- Ⓜ ates ROMable 8080 machine code. Symbolic debug- ⓧ ger included. Supports interrupt procedures, CP/M file I/O and assembly language interface. Real variables can be BCD, software floating point, or AMD 9511 hardware floating point. Version 3 includes Enumeration and Record data types. Manual explains BASIC to PASCAL conversion. Source for the runtime package requires Digital Research's MAC. Requires 32K ..... **$250/$30**

☐ **ALGOL-60** — Powerful block-structured language compiler featuring economical run-time dynamic allocation of memory. Very compact (24K total RAM) system implementing almost all Algol 60 report features plus many powerful extensions including string handling direct disk address I/O etc. Requires Z80 CPU ..... **$199/$20**

☐ **CBASIC-2** Disk Extended BASIC — Non-interactive Ⓜ BASIC with pseudo-code compiler and run-time interpreter. Supports full file control, chaining, integer and extended precision variables, etc. ..... **$120/$15**

MICRO FOCUS

☐ **STANDARD CIS COBOL** — ANSI '74 COBOL stand- Ⓛ ard compiler fully validated by U.S. Navy tests to ANSI level 1. Supports many features to level 2 including dynamic loading of COBOL modules and a full *ISAM file facility. Also, program segmentation, interactive debug and powerful interactive extensions to support protected and unprotected CRT screen formatting from COBOL programs used with any dumb terminal ..... **$850/$50**

☐ **FORMS 2** — CRT screen editor. Output is COBOL data Ⓛ descriptions for copying into CIS COBOL programs. Automatically creates a query and update program of indexed files using CRT protected and unprotected screen formats. No programming experience needed. Output program directly compiled by CIS COBOL (standard) ..... **$200/$20**

Tasty lower prices!

EIDOS SYSTEMS

☐ **KISS** — Keyed Index Sequential Search. Offers com- Ⓛ plete Multi-Keyed Index Sequential and Direct Access file management. Includes built-in utility functions for 16 or 32 bit arithmetic, string/integer conversion and string compare. Delivered as a relocatable linkable module in Microsoft format for use with FORTRAN-80 or COBOL-80, etc ..... **$335/$23**

Software with Manual / Manual Alone

☐ **KBASIC** — Microsoft Disk Extended BASIC with all Ⓛ KISS facilities, integrated by implementation of nine additional commands in language. Package includes KISS. REL as described above, and a sample mail list program ..... **$585/$45**
To licensed users of Microsoft BASIC-80 (MBASIC) ..... **$435/$45**

☐ **XYBASIC** Interactive Process Control BASIC — Full disk BASIC features plus unique commands to handle bytes, rotate and shift, and to test and set bits. Available in Integer, Extended and ROMable versions. Integer Disk or Integer ROMable ..... **$295/$25**
Extended Disk or Extended ROMable ..... **$395/$25**

☐ **BASIC UTILITY DISK** — Consists of: (1) CRUNCH-14 Ⓜ — Compacting utility to reduce the size and increase the speed of programs in Microsoft BASIC and TRS-80 BASIC, (2) DPFUN — Double precision subroutines for computing nineteen transcendental functions including square root, natural log, log base 10, sin, arc sin, hyperbolic sin, hyperbolic arc sin, etc. Furnished in source on diskette and documentation ..... **$50/$35**

☐ **STRING/80** — Character string handling plus routines Ⓜ for direct CP/M BDOS calls from FORTRAN and other compatible Microsoft languages. The utility library contains routines that enable programs to chain to a COM file, retrieve command line parameters, and search file directories with full wild card facilities. Supplied as linkable modules in Microsoft format ..... **$95/$20**
STRING/80 source code available separately **$295/n.a.**

☐ **THE STRING BIT** — FORTRAN character string handling. Routines to find, fill, pack, move, separate, concatenate and compare character strings. This package completely eliminates the problems associated with character string handling in FORTRAN. Supplied with source ..... **$65/$15**

☐ **VSORT** — Versatile sort/merge system for fixed length Ⓜ records with fixed or variable length fields. VSORT can be used as a stand-alone package or loaded and called as a subroutine from CBASIC-2. When used as a subroutine, VSORT maximizes the use of buffer space by saving the TPA on disk and restoring it on completion of sorting. Records may be up to 255 bytes long with a maximum of 5 fields. Upper/lower case translation and numeric fields supported ..... **$175/$20**

☐ **CPM/374X** — Has full range of functions to create or re-name an IBM 3741 volume, display directory information and edit the data set contents. Provides full file transfer facilities between 3741 volume data sets and CP/M files ..... **$195/$10**

☐ **BSTAM** — Utility to link one computer to another also Ⓜ equipped with BSTAM. Allows file transfers at full data speed (no conversion to hex), with CRC block control check for very reliable error detection and automatic retry. We use it! It's great! Full wildcard expansion to send *.COM, etc. 9600 baud with wire. 300 baud with phone connection. Both ends need one. Standard and Ⓜ versions can talk to one another ..... **$150/$5**

☐ **WHATSIT?*** Interactive data-base system using as- Ⓜ sociative tags to retrieve information by subject. Hashing and random access used for fast response. Requires CBASIC-2 ..... **$175/$25**

☐ **SELECTOR III-C2** — Data Base Processor to create Ⓜ and maintain multi Key data bases. Prints formatted † sorted reports with numerical summaries or mailing labels. Comes with sample applications, including Sales Activity, Inventory, Payables, Receivables, Check Register, and Client/Patient Appointments, etc. Requires CBASIC-2. Supplied in source ..... **$295/$20**

☐ **GLECTOR** — General Ledger option to SELECTOR III-C2. Interactive system provides for customized COA. Unique chart of transaction types ensure proper double entry bookkeeping. Generates balance sheets, P&L statements and journals. Two year record allows for statement of changes in financial position report. Supplied in source. Requires SELECTOR III-C2, CBASIC-2 and 52K system ..... **$250/$25**

☐ **CBS** — Configurable Business System is a compre- Ⓜ hensive set of programs for defining custom data files and application systems without using programming language such as BASIC, FORTRAN, etc. Multiple key fields for each data file are supported. Set-up program customizes system to user's CRT and printer. Provides fast and easy interactive data entry and retrieval with **transaction processing**. Report generator program does complex calculations with stored and derived data, record selection with multiple criteria, and custom formats. Sample inventory and mailing list systems included. **No support language required** ..... **$295/$25**

Prices and specifications subject to change without notice.

Software with Manual / Manual Alone

MICRO DATA BASE SYSTEMS

☐ **HDBS** — Hierarchical Data Base System. CODASYL oriented with FILEs, SETs, RECORDs and ITEMs which are all user defined. ADD, DELETE, UPDATE, SEARCH, and TRAVERSE commands supported. SET ordering is sorted, FIFO, LIFO, next or prior. One to many set relationship supported. Read/Write protection at the FILE level. Supports FILEs which extend over multiple floppy or hard disk devices.

☐ **MDBS** — Micro Data Base System. Full network data base with all features of HDBS plus multi-level Read/Write protection for FILE, SET, RECORD and ITEM. Explicit representation of one to one, one to many, many to many, and many to one SET relationships. Supports multiple owner and multiple record types within SETs. HDBS files are fully compatible.

☐ **MDBS-DRS** — MDBS with Dynamic Restructuring System option which allows altering MDBS data bases when new ITEMs, RECORDs, or SETs are needed without changing existing data.

HDBS-Z80 version	**$250/$40**
MDBS-Z80 version	**$750/$40**
MDBS-DRS-Z80 version	**$850/$50**

8080 Version available at $75 extra

When ordering, specify one of the languages listed below.

NOTE

HDBS and MDBS manuals purchased alone come without specific language interface manuals. Manuals are available for the following Microsoft languages. 1) MBASIC 4.51, 2) BASIC-80, 5.0, 3) Compiled BASIC-80 or FORTRAN-80, 4) COBOL-80, 5) MACRO-80 ..... **$NA/$10**

all Micropro prices are discounted!

MICROPRO

☐ **SUPER-SORT I** — Sort, merge, extract utility as abso- Ⓛ lute executable program or linkable module in Microsoft format. Sorts fixed or variable records with data in binary, BCD, Packed Decimal, EBCDIC, ASCII, floating & fixed point, exponential, field justified, etc. Even variable number of fields per record! ..... **$225/$25**

☐ **SUPER-SORT II** — Above available as absolute pro- Ⓛ gram only ..... **$175/$25**

☐ **SUPER-SORT III** — As II without SELECT EXCLUDE Ⓛ ..... **$125/$25**

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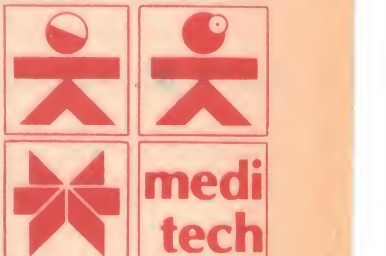

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Microcomputer News & Products

Priced at $1700, the Z8 Development Module became available from April, 1980.

Zilog Inc are also offering a cross-software package that enables users of PDP-11 minicomputer systems to develop code for the 16-bit Z-8000 microprocessor. The package runs on Western Electric Company's Seventh Edition of the popular UNIX time-sharing system, a general-purpose, multi-user, interactive operating system. The UNIX software runs on DEC PDP-11/45 and PDP-11/70 systems.

According to Rolando Esteverena, Zilog Systems Division general manager, the Z-8000 Cross-Software package will allow users of PDP-11 systems to take advantage of the tools of a larger computer system to develop software for their own Z-8000-based products.

More information can be obtained from Zap Systems Pty Ltd, 51-53 Chandos St, St Leonards, NSW 2065.

New Aust distributor

Micro Products has recently been appointed the Australian distributor for the Dennison Kybe range of "Accutrack" magnetic media. The product range includes eight inch flexible disks, mini flexible disks, digital cassettes, power typing cassettes and magnetic cards for virtually any computer in use today. As an adjunct to this range, Micro Products also deals in the range of Kybe Magnetic Tape Cleaners, Testers and Certifiers, Bulk Tape Erasers and Disk Pack Cleaners.

Micro Products is a new Australian company dedicated to the support of the microcomputer user, either as a small business user or computer hobbyist. The address is PO Box 8, University of New England, Armidale, NSW 2351.

Top-loading disc cartridge

A new top-loading disk cartridge designed for specific drive applications is now available from the Data Recording Products Division of 3M Australia Pty Ltd. The 933/1-24 cartridge has 24 sectors and is designed for Data General 6070 drives. Capacity per cartridge is 10 megabytes.

The new single-disk cartridge has 3M's "Crashguard" protective disk coating, which greatly reduces the possibility of damage to the disk surface and to read/write heads because of headcrash.

Further information may be obtained by writing to the Data Recording Products Division, 3M Australia Pty Ltd, PO Box 99, Pymble 2073.

Microcomputer News & Products

300 Megabyte Disc System

Anderson Digital Equipment Pty Ltd has recently announced the introduction of 80 and 300 megabyte Disk Subsystems to suit any DEC PDP-11 system as well as Data General, Nova and Eclipse Mini Computers.

The models S211/80 and S211/300 connect to the Unibus of the PDP-11 computers while the models 850/80 and 850/300 connect to the normal I/O ports of the DG, Nova and Eclipse range.

The 80 megabyte subsystem will sell for approximately $25,000 while the 300 megabyte subsystem will sell for approximately $40,000.

For further information contact Anderson Digital Equipment Pty Ltd, PO Box 322, Mt Waverley, Victoria 3149.

Pro-Log Systems for Z80 & 8085

Pro-Log Corp has introduced STD BUS prototyping systems for the Z80 and 8085 microprocessors. Intended for design engineers using standard engineering techniques, the PS-1 (8085) and PS-3 (Z80) prototyping systems include STD BUS hardware, test equipment, PROM-based applications and operating software and complete documentation.

Each system includes CPU card with 1K of RAM and sockets for 8K of 2716 PROM, power supply card, keyboard display card, TTL I/O utility card and utility card extender.

Applications and operating software are contained in one of three 2716 PROMs provided. Application software includes keyboard and display control subroutines, math modules, timing modules and miscellaneous hardware control modules. Operating software includes a register dump to display and execute programs from a specified starting address.

Additional information is available from AJF Systems and Components, 310 Queen Street, Melbourne, Victoria 3000.

HP expands logic development system

New options available for HP's Model 64000 Logic Development System include five relocating macro assemblers and a 12 megabyte disc drive.

Five new assemblers and a new disk drive are now available for HP's Model 6400 Logic Development System. A 12 megabyte disk drive has been added to the family of hard disks used with the development system, and five new relocating macro assemblers now support program development for the 6809, 8048, 9900, 1802, and F8 microprocessors.

The new disk drive, HP Model 7910H, is a Winchester technology type fixed drive with a 12 megabyte capacity. It is a complete stand-alone unit, including a self-contained HP-IB (IEEE-488) controller and power supply in a table-top cabinet. The new assemblers provide software support for microprocessors other than the four (8080, 8085, Z80, and 6800) presently supported with hardware emulation by the 64000 Logic Development System. The assemblers are fast, operating at 4000 lines per minute regardless of the size of the source file. Each can be ordered as a separate unit or as an option.

For further information contact Hewlett-Packard Australia Pty Ltd, 31-41 Joseph Street, Blackburn, Vic 3130.

New products from Intel Corp

Intel has begun volume production of an upgraded version of its 8086 16-bit microprocessor, and the 2732 32K EPROM, offering speed improvements in both products. The 8086-2 runs at a maximum speed of 8MHz, compared to the 5MHz of the earlier version, and is priced at $200 each in 100 quantities.

To support the processor, Intel has improved the speed of its 450ns 32K EPROM. The new 3732A 32K EPROM has an access time of 200 or 250ns.

Intel are also offering an enhanced memory expandable version of its 16-bit single-board computer, the ISBC 86/12A. The new version allows the addition of two new memory modules that expand the on-board RAM from 32K to 64K, and the on-board ROM from 16K to 32K. Ad-

APPLE II/APPLE II PLUS COMPUTERS come complete with 12K ROM, Cassette Interface, 8 port I/O facilities, tutorial manual, language reference manual, system and hardware reference manual, introductory software manual, leads, connectors, games paddles and introductory software.

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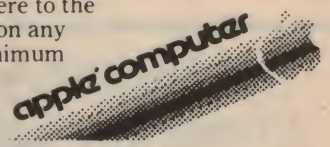

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ditional multi-bus compatible memory boards can be used to further increase memory size to the full one megabyte support by the 8086 CPU.

The corporation has also announced the first in-circuit emulator for "intelligent" peripheral devices and the first multiple-emulation support for the development of multi-processor systems containing such devices. The new ICE-41A in-circuit emulator emulates the 8741A and 8041A universal peripheral interface microcomputers. It will allow designers to use advanced techniques – such as symbolic debugging of programs – to develop intelligent peripheral controllers and other applications of the UPI-41A single-chip microcomputers.

Multiprocessor development support is provided by a new Multi-ICE software package. An enhancement of the Multi-ICE package introduced in 1979, the software enables a single Intellect development system to control and co-ordinate the operations of the new ICE-41A emulator and the ICE-85 in-circuit emulator, which emulates the 8085 microprocessor.

Enquiries to AJF Systems and Components Pty Ltd, 310 Queen St, Melbourne, Victoria 3000.

New computers from D.D. Webster

The new hard disc version of the Spectrum-II range. The machine is available with 10 or 20 megabyte storage capacity and is priced from $16,077.

D.D. Webster Electronics Pty Ltd, Bayswater, Victoria, is now making hard-disc versions of the Spectrum-II business computer with 10 and 20 megabyte storage capacity.

These new free-standing machines are available singly or as a hard disc 10 or 20 megabyte unit, or can be produced incorporating any of the Spectrum-II's single or double drive floppy discs, thus providing the archival advantages of a floppy system with the five to 10 times more filing space offered by cartridge discs.

Prices for the Spectrum-II hard disc models start at $16,077 for a Spectrum-II Z10 (32K bytes of memory), a machine without floppies, and a range through a variety of combinations to the Spectrum-II D20 (64K bytes). The latter sells for $23,195 and incorporates a 20 megabyte storage disc with a double-sided double-density floppy disc Spectrum storing 2.52 megabytes on line.

Enquiries to D.D. Webster Electronics Pty Ltd, 17 Malvern St, Bayswater, 3153.

Coming Next Month*

Power Factor Controller for Induction Motors

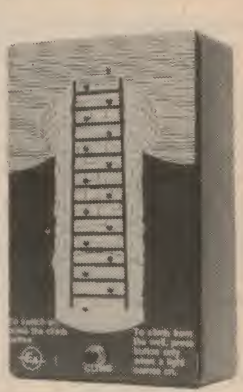
Faced with a worsening world energy shortage we present our version of a NASA-developed power controller which is reputed to give worthwhile power savings with induction motors. Is it worth building? Find out next month.

Eprom Programmer

This is a modified version of the Eprom Programmer in this month's issue. It matches the appearance of the Exidy Sorcerer remarkably well and has software to suit that particular computer.

Leds & Ladders

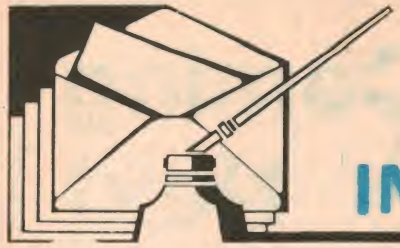
This updated version of our popular Leds & Ladders is sure to be a hit with young and old alike. It is an engrossing game of skill which applies a number of interesting circuit concepts.



Stereo AM Radio

The American FCC has endorsed the Magnavox system. We look at the implications for Australia.

*Our planning for this issue is well advanced but circumstances may change the final content. However, we will make every attempt to include the articles mentioned here.



INFORMATION CENTRE

FREQUENCY REFERENCE: I found the article by Ian Pogson dealing with the Quartz Multiple Frequency Reference (July, 1979) very interesting, enough in fact, to assemble one generally in line with the article, except that I used a 2270kHz crystal, simply because I had one. Also, I found the instrument a lot more versatile than the article indicated. For example, I found that the combination of microsecond steps gave no less than 255 discrete and precise frequency values. These should be useful from the RF to audio range. The reason is, of course, the geometric series 1, 2, 4, 8, 16, 32, 64, 128 can give a continuous series of consecutive numbers from 1 to 255. As these form the divisor into the crystal frequency, a corresponding number of discrete frequencies is also available. I think that its range is worthy of some additional comments. Altogether a very versatile instrument – congratulations. (R. B., Turramurra, NSW).

● Thank you R. B., for your kind remarks and comments.

SQ DECODER: I wish to construct the "Full Logic SQ Decoder" which was published in your February 1977 issue. I have had trouble locating the 3 chips, MC1312, 1314 and 1315. Could you tell me the name and address of a supplier. (J. M., Valla, NSW).

● In view of the age of this project and the very low demand, it is doubtful whether any retailer would have these chips available. We suggest you contact Motorola Semiconductor Products, 37 Alexander Street, Crows Nest, NSW 2065 for further information.

HERRINGBONES AND MASTHEAD AMPLIFIERS: I have built the Masthead Amplifier for TV and FM (EA, August, 1979) and erected it on a 12 foot mast above a galvanised iron roof on a two story residence. A super Colony Model 3111 faces along the length of the roof to the lee side of a hill with respect to Adelaide's TV antennas, with further hills behind. My antenna is probably 50 feet below the line of sight, with the blocking hill 100-150 yards away.

The first point on the coax line is a Rank Arena Colour TV which requires no boost in its own right. However I have a split to an FM set 40 feet away, a further split to a second FM set 35 feet further, and a further split to a second TV set 15 feet away. The total is approximately 130 feet of coax. Channel 9 was hopeless and at times had Channel 2 fully superimposed (both sets). There seemed to be herringbone patterns everywhere. I tried pads up to about 25dB with no effect and even used an AC filter, still with no effect.

During experiments I noticed that as the DC voltage decayed after switch off there was a momentary clear picture. This was observable because I used a much more sophisticated power supply filter employing two dropping resistors and 3 × 1600uF electros, to eliminate hum when listening to FM with headphones. With 2V DC the unit gives only very slight herringbone which can be fine-tuned out. There are no problems with FM and the signal strength meter reads approximately twice that without amplification.

I wonder whether other readers have had similar problems and whether a better solution might have been found. (R. B., Blair Athol, SA).

● Since the masthead amplifier is a wideband device it will be subject to overload by strong signals, as you have found. Unfortunately we can offer no simple solution to the problem. Your solution is interesting but we wonder if it is repeatable, ie, would other devices perform in the same way?

DREAM 6800: I would like to know whether the information regarding the horizontal sync pulses (4us every 64us) is correct, because I seem to be getting a 4us pulse every 32us exactly. If there is no mistake in the article, maybe you would be so kind as to tell me what could be wrong with my computer. (G. K., Chadstone, Vic).

● The horizontal sync pulses of 4us every 64us is correct. If you refer to the circuit diagram in the May 1979 issue, the 2MHz clock frequency is divided by 16 at the D output (pin 11) of IC15. This gives a square wave with a 4us pulse width. Since you are obtaining this pulse every 32us instead of every 64us, then the output of IC16a, pin 6 is driving low at double its correct frequency. The fault possibly lies with the D output (pin 11) of IC14 always remaining high or the NAND gate IC16a is faulty.

DREAM 6800: In the article on the DREAM 6800 (May 1979) it is stated that ". . . In fact, there are 640 bytes free. That's either a damned long machine-code program to hand assemble, or a 320 statement CHIP-8 program . . ." Does this mean that the DREAM is able to be programmed using normal 6800 instruction set as well as using CHIP-8 instructions? (J. B., Lakemba, NSW).

● Yes, it is possible to program the DREAM 6800 in the machine language of the 6800 processor. In fact this is the only way it can be programmed. CHIP-8, the DREAM monitor program, is simply a collection of instructions in machine language (such as input a character from the keyboard, or output a pattern to the screen). Any monitor program is meant to make machine-language programming easier, not to substitute for it.

CHIPOS contains a Call to machine-language subroutine instruction, which may be used to branch to machine-language routines. Each machine-language routine must end with a 39 code (6800 machine language Return from Subroutine), which will cause the program to return to the CHIP-8 instruction immediately following the subroutine call after the machine language subroutine has been executed.

Anyone interested in programming the DREAM 6800 should obtain a copy of CHIPOS – the software manual for the DREAM, written by Michael Bauer. It is available from Dreamware, at PO Box 343, Belmont, Vic 3216. This manual lists the instructions of the CHIP-8 interpreter and explains what each instruction does, as well as providing a list of CHIPOS subroutines and the entry points to them. For machine language programming the Assembly Language Programming Manual for the 6800 or the Motorola M6800 Microprocessor Applications Manual are good reference books.

NANOFARADS, NANNYFARADS ET ALIA: I enjoy building electronic circuits. There are many of yours I would have liked to build but they use capacitors with nanofarad ratings. These capacitors I cannot seem to obtain around Canberra. Could you or any of your staff suggest any stores in Sydney that stock these capacitors or do I substitute? (S. T., Queanbeyan, NSW).

● By way of explanation, a microfarad is one millionth of a Farad, the unit of capacitance, and a nanofarad is one thousandth of a microfarad. So to convert a capacitor specified in nanofarads to the more familiar microfarad value, simply divide by 1000. For example, to convert 6.8nF to microfarads, divide by 1000 to obtain .0068uF. Similarly, 220nF becomes 0.22uF. Just for the record, we do not normally specify capacitor values in nanofarads.

2650 EXPANSION: I have four questions regarding the 2650 Mini Computer System – May 1978, Expansion of the 2650 System – November 1978, and Extra RAM for the 2650 System – December 1978, to which I would be most grateful if you could supply the answers.

Firstly, is it possible to add up to 3 more 8K RAM Boards onto the previous board (using only one buffer board), in the same way that the first one was added?

Secondly, are Page 0. Page 1, Page 2, Page 3 (2650 expansion board, 78UP9) connected to Page Select (RAM Board 78UP10) at the same time (if so, this means that they short each other out at Page Select), or are they connected singly by the use of switches?

Thirdly, to what is BR/W on 78UP9 connected to, if it is not connected, what is it used for?

Finally, where on the board do I get the Control 1 and Control 2 lines on the I/O sockets from? (P. R., North Manly, NSW).

● Firstly, the 2650 Mini Computer system can be expanded to 32K, the maximum addressing capability of the 2650 CPU. To do this you would need to remove the 3K of RAM originally on the CPU board and add 4 8K boards, which will be pages 0, 1, 2, and 3. The first 1K of RAM, locations 0000 to 03FF, will need to be left vacant if you wish to retain Pipbug.

The December, 1978 article on the 2650, pages 87 and 88, gives the details of this page selection. There are practical problems however. You will need to fit the expansion board and four 8K memory boards into the case, and each memory board will consume approximately 1.5A, a total for memory alone of 6A. The four boards will dissipate a considerable amount of heat, and you may have to consider forced air cooling (ie, a fan).

The buffers of the expansion board, in conjunction with the buffers on each memory board, will provide enough drive capability for four memory boards. Interconnection wiring will have to be kept as short as possible to avoid stray capacitance and cross-talk which could degrade the system performance.

In answer to your second question, only one of the four page-select signals is connected to each memory board. The page select signals 0, 1, 2, and 3 from the 74LS138 on the expansion board 78up9 control which 8K board will be enabled, while the 74LS138 on each memory board generate the signals to select blocks of 1K within each 8K block in response to addresses 10, 11, and 12. The word "page" is used to refer to 8K blocks (Page 0, 1, 2, and 3 from the 74LS138 on the 78up9 board) and also to 1K pages within each 8K block.

Each 8K page of memory is connected to one "page select" signal from the expansion board. For full expansion of the system, the first 8K block is connected to Page 0, the second 8K block to Page 1 and so on. Note the comments in the November 78 article about disabling page 0 when Pipbug is selected in an expanded system.

Thirdly, BR/W on board 78up9 is simply a buffered Read/Write signal which has been provided for convenience in other interfacing applications. It could be used, for example, to control a bi-directional I/O port, but need not be connected to anything unless you desire.

In answer to your final question, the control 1 and control 2 lines shown on the I/O sockets are selected from the data outputs of another output port, so that if necessary up to 10 outputs can be taken from the one output socket. As mentioned on page 76 of the November 1978 article, this may be necessary for a particular peripheral device. For example, if data bit 7 from output port C was connected to the control 1 line of output port D, you could use DB7 to control an eight bit latch connected to output port D.

PARTS DIFFICULTIES: I have been buying "Electronics Australia" for the past five years. There are numerous projects that I would like to build, except for the fact that I don't understand where to obtain the printed circuit boards. Could you please explain how to identify the make of PCB, and where to purchase them. (R.P., Anglers Paradise, Qld.)

● Printed circuit boards described in "Electronics Australia" are identified by a small code number which forms part of the copper pattern. This code number is always identified in the parts list, and in the text describing the project.

There are at least two sources for every PC board ever published in "Electronic Australia"; Radio Despatch Service, 869 George St, Sydney, NSW 2000; and RCS Radio, 651 Forest Rd, Bexley, NSW 2207. Other components suppliers also sell PC boards, and their advertisements should be carefully checked. A complete list of those companies to which we supply PCB and front panel artwork will appear on the last page of the next issue.

DIGITAL THERMOMETER: Having been in the graphic arts and X-ray industry as a serviceman for some time. I have great need for a digital hand-held thermometer. Has any thought been given to the design and construction of such a meter?

Programming in Hexadecimal:

MINI SCAMP: Could you please help me, as I have constructed the Mini-Scamp computer but am at a loss with the sample program "Binary Count and Display." In the book "Getting into Microprocessors" it says "As the LDI 8 instruction is a double byte instruction the number 08 must be set into address 02 followed by 35 into 03, and so on" but the instructions leave me flat as to the other double byte instruction 0007 C902 and the next 0009 8FFF. What do I do with 02? (P. R., Ashcroft, NSW).

● The double byte instruction C902 is a Store instruction indexed on pointer register 1, followed by a displacement value (02). In the Binary Count and Display program C9 is loaded into address 0007, and 02 is loaded into the next address, 0008. Pointer register 1 is set to 0800 by the instructions at addresses 0001 to 0006, and when the indexed Store instruction is executed the displacement is added to this value, giving a final value of 0802.

This is the address to which data will be sent in response to the Store instruction. Because of the way the address bus is decoded in the Mini Scamp, address 0802 selects the LEDs on the front panel. This causes the data in the accumulator to be displayed on the LEDs when the C902 instruction is executed, provided that pointer register 1 has been previously set to the base address 0800. The addressing of the front panel LEDs is discussed on Page 45 of "Getting into Microprocessors".

8F is the instruction which causes a delay (DLY) in SC/MP programs, and the length of the delay is set by the value of the displacement which follows this instruction. In the sample Binary Count and Display program the displacement is FF, giving a delay of approximately 260ms. Changing this value will give a shorter delay time. In the sample program 8F is loaded into address 0009, and FF is loaded into the next address 000A.

A8 is the Increment and Load instruction (ILD). It adds 1 to the contents of the address specified by the displacement which follows it (03 in this case). The displacement is added to the contents of the Program Counter, which at this point is 000C (This is the address of the instruction currently being executed). This gives a result of OF (OC+3=OF in hexadecimal arithmetic). Address OF contains the current value of the binary count, and is set to 00 at first, and incremented each time the SC/MP loops through the program.

This looping is caused by the Jump instruction (JMP) 90. The next instruction, F8, is the displacement for the Jump instruction, and causes the program to jump back to address 0007 and go through the program again, storing the contents of the accumulator to the front panel LEDs, waiting for a moment, then adding 1 to the total of the count (held in address OF) and then jumping back to 000C again and repeating the sequence.

The counting program is discussed in the article "Assemble your own Mini Scamp Programs" in "Getting into Microprocessors" Page 99. This article also explains how to calculate address displacements for Jump instructions.

The solution to your problem is to load the instructions in the order they are listed. The first byte of a double byte instruction is loaded into the address shown in the left hand column, and the next byte is loaded into the following address. We hope this clears up your problem.

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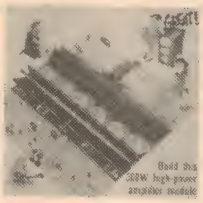

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JT 248	0-10V	10A	$25.95	$2.95	$3.75	$5.50
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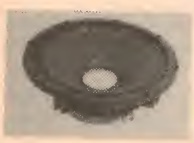
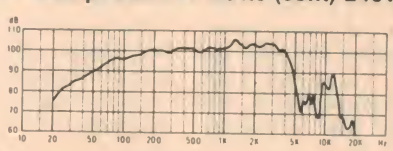


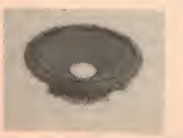


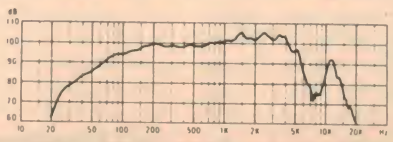
Sound pressure level 101 ± 2dB.
Freq response 4500Hz freq
Reson 40 ± 8Hz Voice coil dia. 80mm
Flux density 10800 gauss
Weight 8.5kg was $125

$95

PP NSW $3; SA Q. V. T. $6.75; WA. NT. $9.75

Model C300K60 12" Max power 150W (cont) 200W peak.





Sound pressure level 99 ± 2dB.
Freq response 5000Hz
Freq reson 60 ± 12Hz Voice coil dia. 65mm
Weight 5.2kg
was $102

$69.95

PP NSW $2.75; SA Q. V. T. $5.50; WA NT $7.50.

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C.	1.8	$3.75	75c

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10 size AA 5AH **$14.75**
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My need is to measure liquid temperatures (eg developer, water) within the range 10°C-50°C and also surface temperatures within the range 100°C-200°C, although the latter is not as important. If possible, an accuracy of ±1°C is required.

I would be very grateful for a project on a digital thermometer, and I'm sure that others would find such a device useful. I've been a regular follower of "EA" for seven years, and have built several of your projects (P.M., St Marys, NSW.)

● Sorry P.M., but we have no plans at this stage to describe a digital thermometer as we believe that its appeal would be quite limited. Of course, we could change our minds if there were other letters indicating otherwise.

SUPER-WOOFER: I was very interested in your project "Super-Bass Filter" in February EA, as I am in the throes of building my own stereo system.

However, I am having difficulty in locating any plans or information on building a super-woofer enclosure. Would you either consider publishing a project to build a super-woofer enclosure, or give me a contact where I might be able to locate some plans for this enclosure. (R.K., Dandenong, Vic.)

● We are considering publishing details for a super-woofer loudspeaker enclosure in a future issue. In the meantime, we had an article on the subject including one suggested design in the May '75 issue (Project file number 1/SE/39.)

2650 SOFTWARE: I recently had a whirlwind introduction to a Signetics 2650 microprocessor which belonged to a friend of mine. In a rash moment, I purchased the unit and a compatible VDU, cassette interface and 12k of memory.

My problem is this. None of my acquaintances have any knowledge of programming such a computer — without using BASIC. I feel that unless I can communicate with the 2650 in machine language, I cannot get the best out of it.

Since almost all the equipment I purchased was from projects in your magazine, I hope you can provide me with software information or a list of articles published. (C.M., Edwardtown, SA.)

● We have published a considerable amount of software for the 2650 computer, and photostat copies of articles and back issues are available through our Reader Services. Below is a list of articles on the 2650 for your information.
October 1977 — Four programs for the Baby 2650 (also suitable for later 2650)
December 1978 — Music and games programs (File No 8/M/32).
January 1979 — 2650 driver routines for the Matsushita printer (2/CC/34).
March 1979 — Utility programs (5 useful subroutines) and a memory test program (8/M/34).
April 1979 — Program for faster loading (300 baud, or bits per second). (8/M/36).
Also in the April issue — 2650 Miniassembler, Lunar lander game, and Micro Basic programs (8/M/37).
August 1979 — A disassembler program (for assembly language listings of machine code programs) (8/M/40).
December 1979 — A random morse code program (8/M/43).
February 1980 — Comments on improvements to the line assembler program and in the same issue a trace routine and two micro basic programs for the 2650. (8/M/45, 46).

An assembler program allows you to load programs directly into memory in mnemonic form (Such as LODI, ZBSR etc) instead of in machine language, which makes programming much easier.

We hope you find this information useful.

COMPUTER PROS AND CONS: Can you tell me the pros and cons of the Dream 6800, 2650 and Miniscamp computers published in your magazine? What is the difference between the 6800 and 6802 chips used in the Dream and can it (the Dream) be programmed in Basic language. (A.B., Essenden, Vic.)

● Most DREAM kits now available use the 6802 microprocessor which is identical to the 6800 as far as programming and instruction set are concerned. The difference between the two is that the 6802 chip contains the clock circuit.

The 2650 computer uses a different microprocessor, namely the Signetics 2650, which has a different instruction set. As published, our design for the 2650 is more readily expandable than the DREAM. Up to 32 kilobytes of RAM memory may be added, for example. However the 2650 has some disadvantages. Firstly, the basic design is for a computer only. The user must add a keyboard and a video terminal before the 2650 can be used.

On the other hand the DREAM already has a hexadecimal keyboard for entering programs, and includes a video display generator, so all that is necessary is to connect it to a television set, either by using an RF modulator such as the one described in numerous articles on TV games, or by using a direct video entry method described in the July 1979 DREAM article.

The Miniscamp computer, although a good design in its time, has been superseded by later designs. Like the 2650, a keyboard and terminal must be added to make a functioning computer system, but the Miniscamp design is not suited to later expansion of the memory.

The DREAM was not designed to use Basic, and Basic instructions can't be run on it. However, the DREAM uses the CHIPOS language, which for some purposes is better than Basic. It uses only 1K of Read Only Memory, instead of the 8K required by Basic, and since all the commands are in hexadecimal form, only a small keypad is needed, instead of the full typewriter keyboards of Basic systems.

CHIPOS is also specially written for graphical displays and computer game programs, and for these purposes it is much easier to use than Basic. This does not mean however that it is less powerful. Once you know how to use it, it is very easy to write a CHIPOS program which would duplicate the function of the Basic statements like X=3: X=X+1 : IF . . . THEN etc.

Electronics Australia Reader Services

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at $2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

PRINTED BOARD PATTERNS: Dyeline transparencies, actual size but of limited contrast: $2. Specify positive or negative. We do not sell PC boards.

PROJECT QUERIES: Members of our technical staff are NOT available to discuss individual projects, either in person at our office or by telephone.

REPLIES BY POST: Limited to advice concerning projects published within the past two years. Charge $2. We cannot provide lengthy answers, undertake special research or discuss design changes.

BACK NUMBERS: Available only until our stocks are exhausted. Within three months of publication, face value. Four months and older, if available, $2 (includes storage fee). Post and packing 60c per issue extra.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

COMMERCIAL, SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

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SORRY NO C.O.D

ADVERTISING INDEX

Technics SL-10

Quartz-Phase-Locked Control Direct-Drive Turntable with Linear Tracking Tonearm

Sounds Alive

Marking the 10th anniversary of the direct-drive turntable.

It has been 10 years since Technics introduced the world's first direct-drive turntable, the SP-10. When it was introduced this turntable had less wow and flutter and better speed accuracy than the cutting lathes used to make records. And because the drive system did not use rubber parts like belts and idler wheels, it insured that its excellent specifications would be retained for a long time.

Six years after the introduction of the SP-10, Technics brought out an improved version, with higher torque and quartz control. Today, more than 1500 of these SP-10MKII's are used by broadcasters in 27 countries around the world.

In the past two years, Technics has added quartz synthesizer control to various models, permitting the precision of quartz to be retained in speeds above and below the standard 33-1/3, 45 and 78 rpm.

More significant to the consumer, Technics has also developed direct-drive turntables which have a very high degree of precision, yet cost much less than the professional grade models. It is possible to get numerous Technics direct-drive turntables in the popular price range, yet with specifications that were obtainable only in very expensive equipment a few years ago.

With the SL-10, Technics continues to lead the industry in turntable innovation. This new turntable represents as radical a departure from conventional design as did the SP-10 ten years ago.

It has the same width and depth dimensions as an LP record jacket, yet within the compact package are an amazingly precise drive system, a gimbal suspended linear-tracking tonearm, a high-grade moving coil cartridge, plus extensive control systems which permit even a complete hi-fi novice to use the SL-10 without any problem. Nearly every operation is automated, with the upper and lower halves of the cabinet closed during record play. And the tonearm is designed so that the system can be stood vertically without any sacrifice in tracking accuracy. The SL-10 marks as great a step forward in convenience as did the development of cassette tapes versus the open-reel format. Yet there is absolutely no loss in reproduction quality. On the contrary, numerous factors in the SL-10's design will significantly enhance the sound from records.

Technics changes the face of turntable technology . . . again.

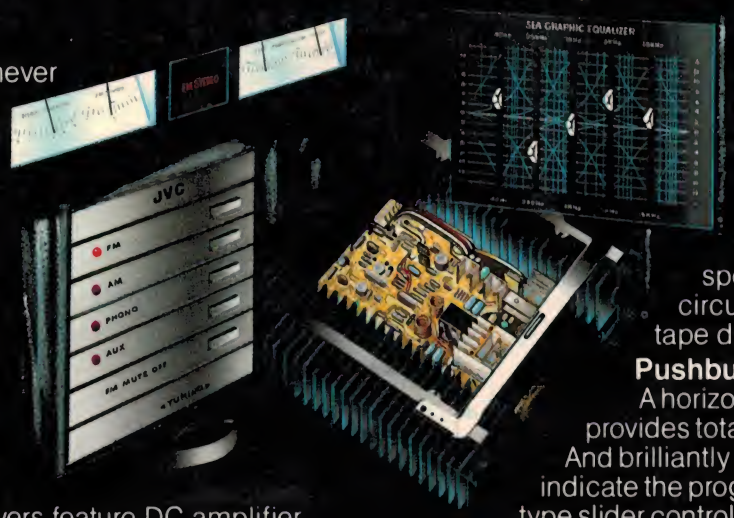
Technics

For further information contact The Technics Advisory Service,
P.O. Box 319, North Ryde 2113

TT2.80

THE JVC RECEIVER.

Every bit as revolutionary as they look, and then some.



In our case, looks are never deceiving. Because all our new DC integrated stereo receivers combine unprecedented, revolutionary styling with unique electronic design features that reflect JVC's more than 50 years' experience in audio development and innovation.

DC Power Amplifier Design

All four new JVC receivers feature DC amplifier circuitry. They offer virtually distortion-free performance (0.03% THD) throughout the entire audible spectrum. As a result, the sound you hear is clearer, cleaner and crisper. In addition, your speakers are protected with the Triple Power Protection circuit and you can monitor output wattage with dual power meters. Choose from 120, 85, 60 and 35 watts/channel.*

SEA all the way

All four receivers offer JVC's exclusive built-in SEA five-zone graphic equalizer for more complete control of the music spectrum than conventional tone controls. You can attenuate or accentuate any of five separate musical bands, and as an added feature, we've incorporated a special button so that the SEA circuit can be switched to your tape deck.

Pushbutton Source Selectors

A horizontal panel of pushbuttons provides total control over all functions. And brilliantly illuminated LEDs instantly indicate the program source. Professional-type slider controls set volume and balance. Combine all these exclusive features with high sensitivity and tuning precision, thumb control tuning wheel and accurate dual-metering and you'll see just how revolutionary the new JVC DC integrated stereo receivers are. Play one at your JVC dealer soon.

For details on all JVC Hi-Fi Equipment, write to JVC Advisory Service, Box 307, North Ryde, N.S.W. 2113.

JR-S 401 (top), JR-S 201 (bottom left) & JR-S 301 (bottom right)

For pure Hi-Fi entertainment!

JVC

the right choice

JR-S501

* @ 8 Ohms, both channels driven from 20Hz-20 KHz, with no more than 0.03% THD.

WT87/78